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Cover: Improved Variety of Tobacco

[*Photo by P. R. R. Pillai*]

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Editorial

THE "PACKAGE" PROGRAMME

THE Pilot Programme for Agricultural Production announced by the Government of India should be considered as most timely and welcome although it is going to cover Seven Districts only—one in each of the seven participating States. The programme envisages making available all the requirements of cultivators in time and on the spot and in addition guaranteeing minimum prices for the produce. This should certainly result in increased production as it fulfils most of the conditions necessary and which have been more than once listed and emphasised in these columns previously.

The only point worth commenting here is that the amount poured in carrying out these programmes should be commensurate with the results likely to be obtained and these projects should serve as models on the basis of which similar programmes could be extended over the rest of the country in as short time as possible with the availability of technical personnel and other prerequisites.

In our opinion, these pilot projects would also help in gauging the actual requirements with regard to finances, fertilizers, seeds, pesticides, etc., on the basis of which the requirements of the entire country could be worked out on far more realistic basis than what is being done at present. By this it is also hoped that the apprehension lingering in the minds of some of our planners, that our demands in respect of these requisites are far more than what would be actually necessary, will be cleared by the working and results obtained in these projects. We look forward with interest to the progress of these seven projects in the coming years.

Research Articles

LIFE-HISTORY, BIONOMICS AND CONTROL OF *HISPELLA STYGIA*, CHAP

By V. V. Thobbi*

I. Introduction

A survey and collections of the Paddy Pests made in Bombay Karnatak, showed that the Case Worm (*Nymphula depunctalis*, G), Paddy Stem Borer (*Schoenobius incertellus*), Gall-Fly (*Pachydiplosis oryzæ*, W), Blue beetle (*Leptispa pygmæa*, B) Ear head bug (*Leptocorisa* sp.), Thrips (*Thrips oryzæ*, W), Grasshopper (*Hieroglyphus banian*, F) and Hispa (*Hispa armigera*, Ol) are the common pests of this crop.

While examining specimens of Hispa on paddy, it was found that there were more than one species and that *H. armigera*, the more common pest of paddy did not agree with the other species which was later identified as *Hispella stygia*, Chap. As very little information on the latter species was available, it was taken up for detailed study, including its distribution, nature and extent of damage, life-history, alternate hosts and control measures, etc.

II. Material and Methods

Whilst in search of alternate hosts of *H. stygia* this insect was found breeding profusely on the wild grasses (*Polytoca barbata*), growing on the bunds of paddy fields. Therefore it was selected as the Laboratory host plant. The cuttings of the grass were brought to the Laboratory and were planted in earthen pots in May to get the sproutings by 2nd week of June. By middle of June they produced tender leaves which were preferred by *H. stygia* for oviposition. The grass was regularly pruned to produce tender leaf blades for these experiments.

For mass breeding, *H. stygia* beetles were collected from the field and were liberated on the host plants enclosed in bell jars the top covered with cloth. Healthy grubs obtained in this way were used for rearing parasites.

For morphological studies infested leaf blades were preserved in a mixture of 75 per cent. alcohol and 5 per cent. glycerine. From

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the preserved material permanent slides of eggs, grubs of different instars, pupæ and adults were made. For the study of grubs of different instars the infested leaf blades were dissected daily. For preparing permanent slides the specimens were treated with 10 per cent. KOH; washed with water and dehydrated in series of alcohol and cleared in clove oil or cedar wood oil. Finally the specimens were mounted in Xylol-balsam medium. By collecting copulating pairs in the fields the sexes were separated and utilised for preparing permanent slides.

The life-history of this insect was studied on jowar seedlings grown in pots during May–June.

The beetles of *H. stygia* that had emerged in the Laboratory and had commenced copulation were liberated in pairs into glass tubes containing the leaf blade of *P. barbata* and daily to each of these tubes, a fresh tender leaf blade was inserted. Every morning the number of eggs laid in each leaf blade was recorded with the help of a hand lens and then a fresh leaf blade was inserted.

III. Alternate Food Plants

H. stygia feeds mainly on the plants of graminæ family. The nature of damage done to all these graminaceous plants is the same, *viz.*, the grubs produce mines in a linear manner.

Since *H. stygia* is known to attack various other grasses which grow wild on the field bunds or in the paddy fields, an extensive survey of these grasses was made on the basis of damage caused by grubs and adults.

The following grasses (in order of preference) were found attacked by *H. stygia.*

Sl. No.	Scientific name	Common name
1	*Polytoca barbata*	..
2	*Dichanthium annulatum*	Marvel
3	*Dichanthium caricosum*	Marvel
4	*Panicum maximum*	Guinea grass
5	*Panicum antidotale*	Blue Panic
6	*Ischæmum pilosum*	Kunda
7	*Themeda* spp.	..
8	*Coix lachryma*	Jab's Tears

IV. Nature and Extent of Damage

The beetles feed on the chlorophyll of the upper leaves and produce the characteristic white parallel streaks of 2–4″ in length and ½ mm. in width. Apart from damage caused by feeding, the female has been found to inflict damage even in the act of oviposition, as prior to actual oviposition, she scratches the epidermal layer with the mandibles for thrusting in the eggs.

The damage done by the grubs is more severe than that of beetles as they feed on the gram tissue between the two epidermal layers by mining into the blades.

When viewed under a hand lens against light, the grub was observed to dig into the green tissue with the pointed bifid mandibles and withdraw the head backward, thus progressing with the tunnel. The body becomes stiff while the jaws are worked. Cast pellets are left behind in broken lines or collected in one corner of the mine. The mined patches were found to measure from 0·25–3·12 sq.in., the average being 1·58 from 20 measurements.

In cases of heavy mining the infested plants showed drying up at the tips. In very severe cases the whole plant succumbed.

V. Life-History Studies

Copulation.—Mating does not take place until the females are 8–10 days old. The male actually rides over the female and is carried by the female on its clytra during the act of copulation which lasts for about 6–8 hours and it occurs almost everyday. The same pair copulates over and over again.

Oviposition.—Female commences oviposition 4 days after it has paired. For oviposition, the female does not confine to any one surface of the leaf. But mostly oviposition takes place on the upper side of the leaf, which is also preferred for feeding purposes. As the egg laying takes place on the apical half of the leaf blade, the mines are concentrated towards the upper half of the leaf. The number of eggs laid per leaf varies from 4–10, depending on the size of the leaf. The habits of the beetle when ovipositing are very interesting. Each beetle before laying the egg makes a general survey of that part of the leaf on which it lands itself. After selecting the leaf suitable for oviposition, the female first scratches and scoops the epidermal surface with the help of her powerful mandibles, and then she turns her abdomen towards the scratched portion, and inserts as egg therein. Then she moves ahead for further egg laying on the same leaf. The preliminary scratching operation and laying of single egg together would occupy

2 minutes. Again within 3 minutes she would lay another egg on the same leaf blade, so on she continues.

From a detailed study on the fecundity and longevity of the adult female from 19–7–1950–27–8–1950 on a series of 10 leaf blades it could be made out that:—

1. A female can daily lay a maximum of 22 eggs, the average being 11·77.

2. The number of eggs laid by a female beetle varies from 22–159 in its entire lifetime.

3. Generally the daily average eggs laid by a female varies from 1·5–11·77. Majority of the eggs are laid during the first 15 days of oviposition.

4. The male beetles live from 11–41 days after emergence and females 11–48 days.

The life of the female can be divided into 3 distinct periods—preoviposition 10 days, oviposition 32 days and post-oviposition 1·77 days.

During the post-oviposition period which lasts for 1–6 days the beetle continues to feed normally except for the last 12 hours of its life when it ceases to feed, becomes lethargic, descends from the leaf and dies.

Life-history of *H. stygia* was worked out in different months during the active season from June–October. The periods of the different stages are shown below:—

Months	Egg stage in days	Grub stage in days	Pupal stage in days	Average Maximum	Temporary Minimum
June ..	5	12	6	81·40	66·90
July ..	5	13	6	79·90	68·70
August ..	6	14	7	79·70	68·90
September ..	6	14	6	86·30	67·90
October ..	7	13	7	85·10	68·30

The total period occupied from the time of egg laying till the emergence of adults was found to be from 23–27 days.

VI. Seasonal History

H. stygia is active from June–October. There are 4–5 broods which generally overlap. The distribution of broods is as under:

Brood	Starting of the brood	End of the brood
1st Brood	2nd week of June	1st week of July
2nd Brood	2nd week of July	1st week of August
3rd Brood	2nd week of August	2nd week of September
4th Brood	2nd week of September	2nd week of October
5th Brood	2nd week of October	2nd week of November

The first two broods are of shorter duration than the 3rd and 4th broods. The 5th brood is not clearly marked. The first brood is mostly found on *P. barbata*. In the month of July and August the *H. stygia* shifts itself to jowar and paddy apart from *P. barbata* which by this time have plenty of tender leaf blades for infestation. So the 2nd and 3rd broods are mostly found on jowar and paddy. In the months of September, October and November it is found breeding on the grasses mentioned in the list of alternate host plants, in addition to jowar and paddy, but to a lesser degree on the latter two.

In the month of November the activity of this insect is much reduced and if passes the cold months on guinea grass (*Panicum maximum*) in the adult stage. This grass is planted on the bunds and being perennial is green throughout the year. Some beetles were collected on guinea grass in the off-season and were reared in the Laboratory. The beetles produced white scars characteristic of feeding habits, but there was no oviposition.

VII. Natural Enemies

No parasites had been recorded so far on this insect. During the course of these investigations 3 kinds of hymenopterous parasites on *H. stygia* grubs (*Campyloneurus* sp., *Elasmus* sp., and *Proacrias* sp.) and a predaceous mite (*Pediculoides* sp.) on the adults were observed. The parasites were identified by Commonwealth Institute of Entomology, London, and the acarid by Dr. Mani of Agra.

Out of the three hymenopterous parasites the first one is ectophagous and the remaining two are endophagous.

VIII. Control Measures

Since the life-history, habits and nature of damage of *H. stygia* is almost the same as that of *Hispa armigera* the control measures that have been advocated for *H. armigera* will hold good for *H. stygia* also.

Chemical control tests in Laboratory.—Laboratory trials were conducted using insecticides based on D.D.T. and B.H.C. (*viz.*, Guesarol 550 which is 50% D.D.T. wettable powder and Hexidole 803 ready to use dust containing 3% technical B.H.C.).

50% D.D.T. wettable powder and B.H.C. dust were used at $\frac{1}{4}$ lb. of 50% D.D.T. wettable powder mixed with 5 gallons of water and sprayed, while Hexidole 803 was dusted as such on the leaf blades containing the beetles. In each case there were 20 beetles and each treatment had 2 replications. Results are shown below:

Sl. No.	Treatment	Insecticidal tests		Death after 24 hours	
		Date of application	No. of insects in each jar	No.	%
1	50% D.D.T. wettable powder	11–9–1951	20	20	100
2	Do.	Do.	20	19	95
3	B.H.C.	Do.	20	18	90
4	Do.	Do.	20	17	85
5	Control	Do.	20	3	12
6	Do.	Do.	20	4	16

As can be seen from the table Guesarol 550 is more effective than Hexidole, the former acounting for about 100% mortality after 24 hours. Compared to control the two insecticides proved very good.

IX. Summary

1. The identity of *H. stygia* as different from *H. armigera*, the latter being the real pest of paddy is established.

2. The nature of damage done by *H. stygia* is the same as that of *H. armigera*. The adults feed on the tender leaves and produce characteristic marks which appear white. The grubs produce linear mines or linear blotches of full depth with closed ends.

3. Life-history of *H. stygia* has been worked out during the season of activity. Egg stage 5–6 days; Grub stage 12–16 days; Pupal stage 5–7 days; whilst the adults lived from 10–46 days. The insect overwinters in adult stage on its alternate host plant, Guinea grass.

4. In addition to the cultivated plants like jowar, maize, paddy and bajri on which *H. stygia* breeds, 8 more grasses which grow in paddy fields, have been recorded as alternate host plants.

5. New parasites have been observed on the grubs as well as on the adults.

6. Control measures with modern insecticides like B.H.C., D.D.T. have been tried. D.D.T. 50% wettable 1 lb. in 20 gallons of water was effective when sprayed.

X. Acknowledgements

I am greatly indebted to Dr. E. J. Vevai, B.Ag. (Bombay), Ph.D. (Wales), Assoc.I.A.R.I. (New Delhi), F.E.S.I., formerly Agricultural Entomologist to Government, Bombay State, Poona, under whose guidance the present investigation was carried out.

I express my thanks to the Commonwealth Institute of London, for identifying the parasites, to Dr. M. S. Mani, D.Sc., Professor of Zoology and Entomology, Agra, for identifying the arachinid parasite, and to the Entomologist, Forest Research Institute, Dehra Dun, for confirming the identification of *H. stygia* beetles.

I am thankful to Dr. M. Puttarudriah, B.Sc. (Hons), M.Sc., Ph.D. (Calif.), Government Entomologist, Bangalore, for going through the paper and making suitable alterations.

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STUDIES ON THE INFLUENCE OF INCREASING LEVELS OF GREEN MANURE ON PADDY YIELDS AND SOIL ORGANIC MATTER STATUS

By B. V. Venkata Rao and S. S. Sirur*

Introduction

The role of organic matter in the maintenance of soil in good physical condition is well recognised. Application of green leaf manure either grown *in situ* or brought from elsewhere to supply organic matter is a common practice in paddy cultivation in the different parts of Mysore State. The value of green manure in the nutrition of the paddy crop is also well known. Experiments conducted in different parts of India (Sethi, Ramaiah and Abraham, 1952) have shown considerable response to green manures the responses being practically as much as that for ammonium sulphate and other nitrogenous fertilisers. A basal dressing of three thousand pounds of green manure is included in the recommended manuriral schedule for paddy in the State (Govindarajan, 1955). The application of larger quantities of green matter is generaly believed to be beneficial but not practised on account of its limited availability. An experiment to ascertain the influence of increasing levels of green manure over the minimal dose on paddy yields and on the soil organic matter status was conducted at the A.R.S., Nagenahalli, for four seasons from 1954 onwards and the results are presented in this paper.

Experimental

A latin square experiment consisting of five treatments with a minimum dose of 3,000 lb. and a maximum of 15,000 lb. was designed. There were five replications. The soil at the Research Station is a sandy clay representing the lands under old channel irrigation system in Mysore District, the analysis being as follows:

The farm is situated on a ridge and the paddy fields slope into adjoining valleys on all sides. The experimental plots were situated in range III A at the end of the slope towards south. The soils in these areas are derived from parent material presumably low in bases

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	Percentages on dry basis		
Coarse sand ..	40·0	Total P_2O_5 ..	0·035
Fine sand ..	26·2	Total K_2O ..	0·08
Silt ..	0·8	Total CaO ..	0·30
Clay ..	28·5	Ex. CaO ..	0·20
pH ..	5·0	Avl. P_2O_5 ..	0·003
		Avl. K_2O ..	0·005

and the soils on the farm have become acidic owing to continuous intensive cultivation of paddy.

The levels of green manure application indicated in the experiment is over a common dose of 30 lb. in the form of amnonium sulphate applied in two equal doses, half at planting and the other half at first weeding and 20 lb. P_2O_5 in the form of superphosphate applied before planting. Soil samples from the different treatments were collected at the end of the experiment in 1957 and analysed for reaction, organic carbon, nitrogen and available P_2O_5. The yield data and analysis of soil are given in Tables I and II.

TABLE I

Yield of paddy grain in lb. per acre

Treatment	1954	1955	1956	1957
1. 3,000 lb. green manure ..	3120	3000	3310	3500
2. 6,000 ,, ,, ..	3160	3440	3650	4000
3. 9,000 ,, ,, ..	3330	3480	3570	2940
4. 12,000 ,, ,, ..	3250	3400	3270	3780
5. 15,000 ,, ,, ..	3230	2920	3220	3500
C.D. at 5% ..	*n.s.*	*n.s.*	*n.s.*	343

n.s.—not significant.

A study of the yield data (Table I) clearly shows a consistent though not statistically significant increase in yields at 6,000 lb. level, no further increase in the yield being observed at 9,000 lb. level and beyond. On the contrary there appears to be a tendency for decline in yields at 12,000 and 15,000 lb. level of green manure application. Even these yield increases referred to above are not significant except in 1957 season.

TABLE II

Soil analysis

	Treatment	pH	Organic carbon %	Total nitrogen %	C/N	Available P_2O_5 in lb. per acre
1.	3,000 lb. of green manure	4·95	0·805	0·074	10·9	9·68
2.	6,000 ,, ,,	4·97	0·765	0·071	11·1	9·44
3.	9,000 ,, ,,	4·88	0·682	0·077	9·0	9·60
4.	12,000 ,, ,,	5·02	0·702	0·069	10·1	8·08
5.	15,000 ,, ,,	4·87	0·749	0·074	10·5	6·80

A perusal of the analytical data (Table II) does not generally reveal any consistent trends in regard to any of the constituents examined. The soil reaction has remained more or less the same in all the treatments. Actually there is a tendency for decrease in organic carbon with increasing levels of organic matter application. There is no consistent variation in nitrogen content in the different treatments. The ratio of carbon to nitrogen is slightly higher at the 3,000 lb. and 6,000 lb. levels than the last three treatments indicating higher proportion of Soil nitrogen to Carbon with higher doses of green manure application. A probable explanation of this would be as stated by Miller (1955) that the contribution to soil humus as a result of green manure applications is not likely to be appreciable since they consist of succulent easily decomposable organic plant tissues with low amounts of lignin and other resistant groups of organic compounds.

SUMMARY

In this paper the results are presented of an experiment conducted for four seasons at A.R.S., Nagenahalli, representing sandy clay soils in Mysore District, on the influence of application of increasing levels of green leaf manure ranging from 3,000 lb. to 15,000 lb. per acre on

paddy yields and soil organic matter status. Though, there are yield increases of the order of almost 10% at 6,000 to 9,000 lb. level they are not significant except in the last year of the experiment. Higher levels than 9,000 lb. seem to indicate a tendency for decline in paddy yields. Similarly analysis of soils from these treatments do not indicate any increase in either organic matter or nitrogen content of soils after a continuous application of high doses of green manure for four seasons.

Acknowledgements are due to Sri. S. Shamanna for the assistance rendered in analytical work of the soil samples.

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THE EFFECTS OF SOAKING SUGARCANE SETTS IN WATER AND IN AGALLOL SOLUTION ON GERMINATION OF SUGARCANE

By M. B. Tippannavar[1] and S. V. Hiregoudar[2]

Introduction

Sugarcane is an important money as well as rotational crop in the Visvesvaraya Canal Tract of Mandya in Mysore State. The average yield in this area is about 25 tons per acre. One of the main reasons for low yields is the poor germination which varies from 35–40%. Many workers have reported the beneficial effects of soaking setts in water, and treating the setts with Agallol solution, resulting in the increase in germination. The organo-mercurial compounds are being used for seed treatment in the sugarcane growing countries like Mauritiaus, Queensland, S. Africa, Hawai, etc. In Bombay State it is a common practice on the sugarcane estates of the factories. With a view to get higher germination per cent of sugarcane, preliminary studies were carried out at the Sugarcane Research Station, Mandya, during the year 1958; and some of the details are presented in this paper.

Review of Literature

Dellewijin (1951) reports that soaking in cold water for 12–24 hours was a common practice in Java by the end of last century and in Hawaii soaking in cold water for 24–48 hours has been successfully followed for many years. Vijayasaradhy *et al.* (1954) have reported that soaking setts in water for 12, 24, 48 hours have given 63, 50, 23% of germination respectively, indicating the deleterious effect of soaking setts in water over longer period. Khanna (1943), Rao (1937) and Mathur (1941) have recommended favourable effects of soaking setts in water. Kolhe (1954) and Tonapy (1954) have reported that Agallol treatment gives higher germination.

Material and Methods

The experiment consisted of 4 treatments.

A. Control.

B. Soaking setts in running cold water for 24 hours.

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C. Dipping setts in 0·5% Agallol solution for 2 minutes.

D. Soaking setts in running cold water for 24 hours *cum* dipping the setts in 0·5% Agallol solution for 2 minutes.

The layout was randomised plot design with 4 replications.

The type of soil was sandy loams and the variety of sugarcane used was Co. 419. 30 lb. of Nitrogen in the form of Ammonium Sulphate and 100 lb. P_2O_5 in the form of Single Superphosphate was applied at the time of planting. The size of each plot was 15′ × 6′ (2 rows). Three eyebudded ten setts were planted in each row on 12–12-1958. The number of irrigations given was eight. Weekly germination counts were taken for 6 times beginning from the 2nd week.

Results

The 2nd week germination count taken on 26–12–1958 and the 7th week germination counts taken on 23–1–1959 are given in Table I.

Table I

Germination counts of 2nd and 7th week (average of 4 replications)
(Planting date 12–12–1958)

Treatments	Germination Counts	
	2nd week 26–12–1958	7th week 23–1–1959
A	2·25	24·50
B	2·75	28·75
C	4·25	31·75
D	4·75	38·05
C.D. at 5% level p.p.	0·65	4·32
C.D. at 1% level p.p.	..	6·31

From the 1st germination counts taken on 26–12–1958, it can be seen that dipping in 0·5% Agallol solution and soaking in water *cum* dipping in Agallol have given significantly higher germination over soaking in water alone and control, thus indicating the hastening effect of Agallol on germination even in the initial stage. From the foregoing

table, it is also observed that all the treatments have given significant increase in germination over the control. Although there is no significant increase in germination between soaking setts in water and dipping the setts in Agallol solution, the latter has given about 6% more germination than the former, while the treatment soaking the setts in water *cum* dipping in Agallol solution has given highly significant increase in germination over all the other treatments.

It is clear that the increase in germination of all the treatments (except control) has been accelerated and it is more so in case of the treatment soaking setts in water *cum* dipping in Agallol solution.

Discussion

With soaking of setts in water for 24 hours the germination of setts is enhanced by about 7%. This is so because the outer scales of eyebuds get softened and this facilitates the germpore to sprout earlier. Dipping of setts in 0·5% Agallol solution has given about 12·6% higher germination over control, because the organo-mercurial compound will sterilise the setts (cut ends) as stated by Clements (1958) thus eliminating the attack of micro-organisms present in the soil and accompanying the setts. Similar higher percentage of germination was also obtained by Tonapy (1954) and Kolhe (1954). The treatment soaking setts in water *cum* Agallol solution has given 23·9, 17·0, 11·3% more germination over control, soaking in water only, and Agallol only, respectively. This indicates that the effect of Agallol on germination of setts is more pronounced when combined with soaking setts in water for 24 hours, as there is beneficial and cumulative effects of both soaking setts in water and dipping in Agallol solution.

Economics

The extra cost of treating the setts with Agallol works out to Rs. 5·25 as under:

	Amount Rs. nP.
Cost of one pound of Agallol to treat 12,000 setts required per acre	4 00
Two women labourers to treat the setts	1 25
Total ..	5 25

The extra cost of Rs. 5·25 is negligible, if the increase in germination is taken into account.

Summary and Conclusions

A trial to study the effects of soaking sugarcane setts in water and dipping in 0·5% Agallol solution, singly and in combination, on the germination was carried out at Sugarcane Research Station, Mandya, during the year 1958. The results show that the combined treatment of soaking setts in water and dipping in 0·5% Agallol solution has given highly significant increase (23·9) in germination over the control.

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PHOSPHATES FOR CITRUS

By K. M. Aiyappa[1] and C. K. Subramanian[2]

Introduction

The loose jacket mandarin orange—*Citrus reticulata* Blanco—is extensively grown in Coorg and Wynaad. Varadarajan and Subramanian (1953) while describing the citrus soils in Coorg have reported that it is acidic, low in available phosphorus and rich in iron and alumina being lateritic in origin. Govinda Iyer and Rajagopala Iyengar (1956) have reported similarly on Wynaad soils. Aiyappa (1957) has reported low level of P in citrus leaves, in Coorg. Ramakrishnan (1954) has reported deficiency of phosphorus among others in citrus leaves from Wynaad. Thus there would appear to be sufficient reason to believe that citrus would respond to applications of phosphates. Aiyappa (1958) has laid out a factorial experiment to find the response to different levels of N, P and K with yielding citrus trees at Chethalli. But in the nursery and the early stages of planting the common practice in this region is to focus all attention on nitrogenous fertilizers to the complete exclusion of phosphates. It was thought worthwhile to find the response to P in the nursery stages of raising citrus.

Materials and Methods

Four-month old seedlings of uniform vigour were potted one seedling per pot in the last week of June, 1956 using orchard soil. The following treatments, replicated six times, were given in October, 1956.

(i) Control.

(ii) ½ ounce rock phosphate per seedling.

(iii) 1 ounce rock phosphate per seedling.

(iv) 2 ounces rock phosphate per seedling.

(v) ½ ounce superphosphate per seedling.

(vi) 1 ounce superphosphate per seedling.

(vii) 2 ounces superphosphate per seedling.

The pots were hand-watered regularly and had an uniform application of ammonium sulphate 1 ounce per pot along with the above phosphatic manures in October 1958.

[1, 2] Citrus Die-back Scheme, Gonicoppal, Coorg.

TABLE I

Treatments	Control	½ ounce rock phosphate	1 ounce rock phosphate	2 ounces rock phosphate	½ ounce super-phosphate	1 ounce super-phosphate	2 ounces super-phosphate	C.D. at 5%	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)		
Dry weights of roots (in g.)	3·78	6·75	7·38	9·20	8·53	11·08	10·70	3·67	6 7 4 5 3 2 1
Dry weights of shoots (in g.)	3·23	7·00	7·01	9·60	11·18	10·57	10·78	4·23	5 7 6 4 3 2 1
Dry weight of total plant (in g.)	7·02	13·75	14·40	18·80	19·71	21·65	21·48	7·72	6 7 5 4 3 2 1
Number of leaves per plant	39·3	69·5	64·2	74·7	70·7	70·7	76·7	23·70	7 4 6 5 2 3 1
Height of plants (in cm)	19·5	23·0	31·3	30·7	32·7	24·2	28·7	5·96	5 3 4 7 6 2 1

Results

In June 1957 the soil in the pot was loosened and removed by profuse watering and the plants with all the roots intact was washed free of soil. The plants were oven-dried. The roots were weighed separately and the stem and leaves were weighed together which is shown as shoots in the table.

As was expected there was a significant response to application of P. The response to superphosphate was greater than that to rock phosphate. The three superphosphate treatments and the 2 oz. rock phosphate treatment gave significantly better response in root and shoot growth than the control and the $\frac{1}{2}$ oz. and 1 oz. rock phosphate treatments. This is only natural since the phosphate in super is more readily available than in rock phosphate. Higher doses of super did not give significantly better growth indicating that $\frac{1}{2}$ oz. superphosphate has probably supplied the P needs to the seedlings within the short period during which they were under trial. In the case of rock phosphate the higher dose of 2 oz. is indicated for a significant response. Hence it is obvious that in Coorg soils attention should be paid to the P needs of citrus seedlings when they are in the nursery stages.

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RESPONSE OF OLD MANDARIN TREES (*CITRUS RETICULATA* SWINGLE) TO FERTILIZATION AND MICRO-NUTRIENT SPRAYS IN COORG

By K. M. Aiyappa,[1] N. N. Dikshit[2] and K. M. Bojappa[3]

Coorg is famous for its oranges, and they constitute the most important fruit crops of this district, with an area of about 22,000 acres. Till recently, cultivation of oranges was paying in Coorg.

During the last decade, however, a number of orchards showed loss of vigour, widespread occurrence of interveinal chlorosis and mottling, die-back of young shoots, general chlorosis and unfruitfulness. These symptoms have been termed by the local planters as frenching, die-back or decline and by some scientific workers as neglectosis. Since most of these symptoms have been found to be related to deficiency of a number of micro and macro-elements in the mandarin plants in other countries, the results of work conducted at this Station on these aspects are reported here.

Review of Literature

The problem of decline of mandarin oranges has attracted a good deal of attention of scientific workers in India. Bhat (1945) discussed the problem of die-back in Western parts of the country and concluded that die-back was caused primarily due to malnutrition. Marudharajan (1948) working in the former province of Madras attributed the decline of oranges to deficiency of micro-elements, but failed to obtain a favourable response by giving foliar sprays containing boron, zinc or copper to the affected plants. Ramakrishnan (1954) felt that insufficient moisture during summer months and lack of nutrition was probably responsible for the trouble. Similarly Iyer and Iyengar (1956) and Mariakulandai and Dorairaj (1958) obtained results indicating that the trouble is mostly due to nutritional deficiencies. Recently Asana (1958) reviewed the problem of die-back of citrus in relation to cultivation of these fruits in India and observed 'It would appear that along with malnutrition, virus infection is also concerned with die-back'. However, he also pointed out that before attributing the trouble solely to virus, it will be necessary to eliminate by very careful study the effects of adverse environmental conditions.

[1, 2, 3] Co-ordinated Scheme for Citrus Die-back Disease, Coorg.

Under conditions prevailing in Coorg, Mukherjee (1949) reported deficiency of zinc and manganese in Coorg soils and low quantities of these elements in the leaves of affected plants. He could not get complete cure by spraying Zn and Mn salts on affected plants. Similar results reporting incomplete recovery of old plants following sprays with chemicals containing zinc, and low intensity of chlorosis on young plants which receive annually two sprays of zinc have been published by Dikshit (1959, 1958). From the review of literature given above, it appears that zinc deficiency may be present in Coorg along with the deficiency of other micro or macro-elements. The present study was, therefore, taken up to find out the response of old plants to adequate fertilizer application accompanied by sprays of different micro-elements which are already reported to cause symptoms if absent from the soils.

Materials and Methods

The trial was conducted at Pollibetta, Coorg, where minimum and maximum temperature vary between 40° F. and 95° F. respectively. The annual rainfall during the last four years (1955–58) has varied between 58·45″ during 1957 and 95·92″ during 1956.

The experimental plants were selected on the basis of uniformity of age, vigour and intensity of chlorosis. The plants were 20 years old and about 90 per cent. of the leaves were affected (on the basis of eye estimate for the whole tree). In a general survey of the orchard (during 1955) in which the trials were laid out, out of 420 plants observed 88·7 per cent. showed mottling of leaves. In another adjacent area 500 plants were examined and 76·8 per cent. were found to be having mottled leaves. These observations were recorded during December 1955. Further observation on another 100 plants near the experimental site revealed occurrence of mottling to the extent *plus* 92 per cent. during 1958, thus indicating that generally in the area under question, plants continued to show widespread incidence of mottling.

Details of Spray Treatments

The micro-elements, when sprayed singly, were sprayed as sulphates 5 : 2½ lime : 100 gallons of water, boron was sprayed at 1 lb. of boric acid in 100 gallons of water and molybdenum as 1 oz. of ammonium molybdate in 100 gallons of water.

When the micro-elements were used together the quantity of each was proportionately reduced, *e.g.*, when two micro-elements were combined the quantity of each was reduced to half of the dose given above, and when 3 and 4 were combined, the quantity of each was reduced to ⅓ and ¼ respectively.

In each calendar year, except 1955, the plants received 2 sprays. The details of spray treatments are as follows: 1955—one spray during November; 1956—two sprays—one each in June and November; 1957—two sprays—one each in June and November; 1958—two sprays one each in June and November.

The details of the spray treatments are given below. The experiment was laid out in two parts.

Part I		Part II	
Sl. No.	Spray treatments	Sl. No.	Spray treatments
1	Water (Control)	1	Control
2	Zinc	2	Magnesium
3	Manganese	3	Molybdenum
4	Copper	4	Boron
5	Iron	5	*Mixture
6	Zinc+Manganese	6	*Mixture+Magnesium
7	Zinc+Copper	7	*Mixture+Molybdenum
8	Zinc+Iron	8	*Mixture+Boron
9	Manganese+Copper	9	*Mixture+Magnesium+Molybdenum
10	Manganese+Iron	10	*Mixture+Magnesium+Boron
11	Copper+Iron	11	*Mixture+Molybdenum+Boron
12	Zinc+Copper+Manganese	12	*Mixture+Molybdenum+Boron+Magnesium
13	Zinc+Manganese+Iron		
14	Manganese+Iron+Copper		*Mixture consists of Sulphate of Zinc, Copper, Manganese+Iron
15	Zinc+Manganese+Copper+Iron		
16	Zinc+Copper+Fe		
	Design: Randomised block. *Replication*: Three. *Experimental trees per treatment*: Three.		*Design*: Randomised block. *Replication:* Three. *Experimental trees per treatment*: Three.

Results and Discussion

In the earlier stages of the observations no significant differences could be observed on the intensity of chlorosis, but the plants improved a good deal in general appearance, which was attributed mainly to the fertilizer treatment rather than to the micro-nutrient sprays.

In the fourth year after the start of this experiment, a clearer picture has emerged and sprays by some of the micro-nutrients have given better results than the others. The figures are given in Table I.

Table I

Intensity of chlorosis (occurrence of chlorotic leaves expressed as percentage of total leaves on the plants) on mandarin plants under Part I of the spray trial. The treatments are arranged according to the intensity of chlorosis

Sl. No.	Treatment	Percentage of affected leaves on whole tree basis
1	Zinc	18·0
2	Zinc+Manganese	24·43
3	Zinc+Copper+Manganese	26·23
4	Zinc+Copper	26·37
5	Manganese+Copper	29·13
6	Zinc+Manganese+Iron	31·10
7	Zinc+Manganese+Copper+Iron	32·10
8	Zinc+Iron	32·43
9	Zinc+Copper+Iron	40·70
10	Manganese+Iron+Copper	46·53
11	Copper	47·80
12	Copper+Iron	55·13
13	Manganese	58·00
14	Manganese+Iron	61·23
15	Water	72·23
16	Iron	72·97

S.E.: 96·2; C.V.: 22·8; C.D. at 5%: 16·03

It is interesting to note that zinc sprays, when given singly, were able to reduce the intensity of chlorosis on the plants much better than any other chemical tried, when sprayed singly or in combination.

Further all the combinations which contained zinc generally showed lower intensity of chlorosis. In fact, among the first 9 treatments listed in the table on the basis on increasing percentage of chlorosis all but one contains zinc.

This finding agrees with the results reported by Mukherjee (1949) in Coorg where he obtained some response to zinc sprays but could not cure the plants completely.

These results are also in agreement with other studies in progress at this Station where the micro-nutrient sprays are being given to the young plants singly. The plants are about 4 years old now and are under trial for the last 3 years. The figures in this case show lowest intensity of chlorosis on plants sprayed with zinc, followed by those sprayed with copper, magnesium, boron, molybdenum, iron, manganese and water (*Annual Report for* 1957–58, pp. 22–23).

In both the trials (with old plants at Pollibetta and with young plants at Citrus Die-back Station, Athur) plants sprayed with manganese, iron or water were always comparatively more severely affected. A number of leaf samples collected from comparable growth cycles and of strictly uniform age, from 3-year old plants, when analysed spectrographically, showed 1·4–5·3, p.p.m. Zn on oven-dry basis. This amount would appear to be low specially when viewed in relation to the standards laid down for Valencia orange leaves, namely 25–100 p.p.m. content of Zn in the leaves as optimum and less than 15 p.p.m. as indicating deficiency. The response obtained, and the low content of Zn in the leaves points out towards a strong possibility of deficiency of zinc, in mandarin plants in Coorg.

Figures collected from plants growing under Part II of the trial with micro-elements are given in Table II.

It is seen from the figures that the differences in the intensity of chlorosis due to spray treatments are not significant. It is interesting to note that unsprayed plants, as well as those sprayed with the uniform mixture, have similar intensity of chlorosis. There also seems to be a clear reduction in the intensity of symptoms when the individual micro-elements, *e.g.*, Mg, Mo and B are sprayed along with the mixture, in each case the former set of plants have a higher intensity of chlorosis than the latter. Since these studies are still in progress, a more clear picture of the response is likely to emerge after one or two years. In the meantime the results on hand available from Part II of the lay-out can be taken as indicative of response and not conclusive.

TABLE II

Intensity of chlorosis on plants in Part II of the trial (expressed as per cent. per plant)

	Intensity of chlorosis expressed as per cent. per plant
Control ..	59·23
Magnesium ..	46·67
Molybdenum ..	53·77
Boron ..	58·43
Mixture ..	59·33
Mixture+Mg ..	38·77
Mixture+Mo ..	48·77
Mixture+B ..	40·33
Mixture+Mg+Mo ..	47·23
Mixture+Mg+B ..	45·43
Mixture+Mo+B ..	47·67
Mixture+Mo+B+Mg ..	43·23

S.E.: 10·42; C.V.: 21·21%; General Mean: 49·07.

SUMMARY AND CONCLUSION

Results of trial conducted to find the effect of good manuring and micro-nutrient spray treatments, on 20–24-year old mandrain trees of seedling origin, growing at Mocha—Pollibetta, Coorg, are reported. The manuring and spray programme has been in progress on these plants for last 4 years.

During the course of this study each experimental tree received on an average 1·55 lb. of N, 1·24 lb. of P_2O_5, 0·74 lb. of K_2O and 1·62 lb. of CaO annually, of these CaO was not applied separately, but since it is present in the phosphatic fertilizers (rock phosphate and super-phosphate) the quantity applied to the plants has been taken into consideration.

In one set of the experiment zinc, manganese, copper and iron were applied singly and in combinations. Out of these, treatment with zinc singly and in combination with others have given good results and the plants seem to have recovered. The differences in the intensity of chlorosis on the plants receiving different spray treatments were found to be statistically significant. In the other set of experiment sprays with magnesium, molybdenum and boron were tested singly and with a uniform mixture containing zinc, manganese, copper and iron. The differences in intensity were not significant, but between the plants sprayed with Mg, Mo and B singly and those on which these were sprayed along with mixture, the latter showed lower intensity. Further work is in progress.

Acknowledgement

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A PRELIMINARY STUDY ON WEED CONTROL IN SUGARCANE CROP AND ACCELERATING CANE GERMINATION

By K. R. Kulkarni*

I. Introduction

Good initial stand of crop is most important in successful crop production. This is true in case of sugarcane, where germination is many a time delayed, due to adverse soil conditions.

The second important problem in sugarcane culture is to control the weeds, which spring up almost along with germinating shoots. In the earlier stages, it is difficult to undertake hand-weeding. Many a time labour is not available at reasonable rates in the intensive sugarcane growing areas. If the weeds are not controlled in time, they cover up the crop reducing the vigour of germinating shoots. In the later stages, heavy weed growth tells upon the tillering capacity of the mother-shoots.

II. Background

Organo-mercurial compounds such as *Agallol* and *Aretan* have been put up in the market, for seed treatment, before planting, with a view to obtaining quick germination and vigorous shoots. It has been reported by Tonapi (1954) and Kolhe (1954) that organo-mercurial compounds have a favourable effect in promoting early germination and vigorous shoots.

In a series of experiments conducted at the Agricultural College, Poona, Arakeri (1951) has shown that it is possible to control weed growth in sugarcane by spraying 2: 4 D, at the rate of $1\frac{1}{2}$ lb. of acid equivalent per acre, as a pre-emergence treatment. Two sprayings are essential, the first after 5 days after planting and the second after 25 days. It has been observed that the sugarcane crop suffers some set-back in the initial stages, due to spraying with 2: 4 D; but, however, this is only temporary in effect.

III. Materials and Methods

The object of the present investigation was to test the efficacy of *Aretan* in promoting germination and giving vigorous shoots and as a counteracting agent for the initial set-back due to the spray of 2: 4 D.

* Agricultural Demonstrator, Arabhavi.

A small-scale trial was laid out in *Adsali* Seed Area planted on 2–8–1958 at Arabhavi. Uniform manurial dose of 100 lb. of P_2O_5, 100 lb. of K_2O, 300 lb. of nitrogen with a uniform basal dose of 20 cart-loads of farm-yard manure was applied per acre. There were four treatments as under:

A—Control. No spraying and no seed treatment.

B—Fernoxone spray at $1\frac{1}{2}$ lb. acid equivalent, sprayed twice.

C—Sets dipped in *Aretan* 1 lb. in 40 gallons of water.

D—Fernoxone spray *plus* sets dipped in *Aretan* as in above.

The design of the trial was randomised blocks replicated 4 times. There were 4 rows in each treatment. The length of each row was 33′. Thirty sets of 3 eye-buds each were planted per row.

Results

Weeds were removed in all treatments twice and the broad leaf and grass weeds were weighed separately. The data obtained are presented in Table I.

Table I

Showing weight of weeds in lb. and oz. per plot on 7–9–1958

Replication No.	A				B				C				D			
	B		G		B		G		B		G		B		G	
	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.
I	32	10	53	3	1	4	2	2	8	10	35	11	2	5	4	0
II	19	7	16	15	1	8	4	3	24	12	23	0	2	0	5	2
III	14	7	24	7	0	6	3	2	9	2	26	7	0	4	3	1
IV	10	12	10	10	0	14	4	0	7	8	9	4	1	8	3	4
Total ..	77	4	105	3	4	0	13	7	50	0	94	6	6	1	15	7

	Broad weeds lb. oz.	Leaf Grasses lb. oz.
Total weeds in untreated plots A & C ..	127 4	199 9
Total weeds in treated plots B & D ..	10 1	28 14
Percentage control ..	92·10	85·5

TABLE II

Showing weight of weeds in lb. and oz. per plot on 11–10–1958

Replication No.	A				B				C				D			
	B		G		B		G		B		G		B		G	
	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.
I	5	14	8	2	1	2	0	15	2	14	7	5	1	0	0	12
II	1	14	2	13	0	15	0	13	3	4	2	0	1	3	0	9
III	0	15	1	9	0	14	0	12	0	13	0	14	0	4	0	7
IV	1	8	3	4	0	6	0	6	0	9	0	13	0	4	2	11
Total ..	10	3	15	12	3	5	2	14	7	8	11	0	2	11	4	7

	Broad weeds lb. oz.	Leaf Grasses lb. oz.
Total weed growth in untreated plots A & C ..	17 11	26 12
Total weed growth in treated plots B & D ..	60	7 5
Percentage control	66	73

Periodical germination and tillering and plant population counts were maintained in the plots uptil earthing up and later. The data obtained has been summarised in Table III.

During December 1958, there was a serious attack of top-shoot-borer and hence, the affected shoots were removed.

Regarding the vigour of shoots, it may be stated that the shoots in the sprayed plots appeared to be thinner with narrow leaves, until the first manurial dose and light earthing, which was given after 6 weeks of planting. Later on, the vigour of shoots was almost uniform, in both sprayed and unsprayed plots, and also between treated and untreated plots with *Aretan* as seed treatment.

V. DISCUSSION

It is beyond doubt, that 2:4 D sprayed as a pre-emergence treatment, 5 days and 25 days after planting, at the rate of 1½ lb. of acid

TABLE III

Showing germination % and tillering in different treatments (Average of 4 replications)

Observations	A	B	C	D
Germination % at 4 weeks	62·22	57·78	73·32	74·44
Germination % at 6 weeks	65·56	57·78	77·77	76·64
Germination % at 8 weeks	68·90	63·33	78·90	80·00
Plant population per row 13 weeks of planting	173	166	188	186
Tillering % calculated	179·00	191·00	165·00	158·00
Plant population per row after earthing up. 1st week of January 1959	139	138	142	146

equivalent per acre; controls both broad-leaf as well as grass weeds, to the extent of 90% on weight basis. Also, this has a residual effect, in controlling the weeds to the extent of about 70% even up to approximately 3 months' time. Afterwards, the cane covers the ground and there is practically no necessity to take any weed control measure. The plot remains clean throughout.

Fernoxone (sodium salt of 2 : 4 diphenoxy acetic acid) has some deleterious effect on germination of cane. The germination is delayed and is reduced by about 5%. However, this has no effect on tillering. From the data presented in Table III, it can be seen that the treatment "D" where the sets are dipped with *Aretan* and spraying is undertaken for weed control, shows the maximum germination percentage, both at 4 weeks and 8 weeks. Treatment with *Aretan* has given about 12% higher germination over control and 17% higher over Fernoxone sprayed plots, without seed treatment. It is also further noticed that in the presence of seed treatment with *Aretan*, Fernoxone spray has practically shown no deleterious effect on germination.

Regarding the vigour of shoots, as has been pointed out earlier, the difference practically disappeared after the first manurial dose. At present, the stand of the crop is uniform for eye-judgment. Quantitative observations on milleable canes will be continued further.

Conclusions

From the foregoing data and discussions, it is quite evident that the object of weed control, better germination, vigorous shoots and more number of canes per acre can be achieved by combining seed treatment of sugarcane sets with organo-mercurial compounds, such as *Aretan* and spraying with 2:4 D, twice at the rate of $1\frac{1}{2}$ lb. of acid equivalent per acre.

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A NOTE ON THE MOTH *DEILEPHILA NERII* (LINN.) (SPHINGIDAE: LEPIDOPTERA)

By D. V. Murthy*

Introduction

The Sphinx or Hawk-Moths (Sphingidæ) are an interesting group though not so important economically as many other moths. It is perhaps for this reason that this group has not received wide attention although some of its species are major insect pests. The important papers dealing with Hawk-Moths in our country are those of Scott (1931, 1933) and Ayyar (1938).

The Oleander (Nerium) is a common ornamental and flowering plant found all over the country. Two types of flowers are commonly met with—red and white which are used as temple offerings and also for hair adornment by women. It is grown all over the country on account of its habit of flowering almost throughout the year. It is a hardy plant able to withstand considerable drought.

The Moth *Deilephila* has a wide distribution occurring all over India, Burma and Ceylon. It is a nocturnal species, olive-green in colour and stout in build. The sexes vary in size, females being generally stouter than the males. The range of wing-expanse of the moths across the abdomen vary from 95·00–100·00 mm. in females and 70·5–80·0 mm. in males. According to Bell and Scott, it is 84–126 mm. and 84–116 mm. respectively.

Host Plants

Although the insect commonly confines itself to *Nerium*, it is known to feed also on *Jasminum*, *Tabernæ montana coronaria*, *Holarrhena antidysenterica* and some other plant species.

Biology

Copulation has not been observed and probably takes place at night. The pre-ovipositional period ranges from 3–4 days. Hatching period is about 5 days, some eggs hatching even as late as 10 days after deposition. A day after being laid, the eggs begin to turn dark in colour. The individual egg measures on an average $1 \cdot 0 \times 1 \cdot 2$ mm.

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Freshly hatched larva is 5·0–6·0 mm. in length and pale lemon-yellow in colour. The 8th abdominal segment bears an obliquely projecting dorsal horn measuring 3·0 mm. The horn is broad at the base and tapers above and is dark in colour.

The freshly hatched larva feeds voraciously by attaching itself to the underside of the oleander leaf.

The 2nd instar larva is variable in size measuring from 18·0 mm. up to 34·0 mm. in length and 3·0–8·0 mm. in width. The colour is dark green instead of lemon-yellow. Conspicuous large blue eye-spots are visible behind the thorax.

The 3rd instar larva measures from 48·00–52·00 mm. in length and 8·0–11·0 mm. in width. The larva is dark brown in colour. Feeding is comparatively less during this period.

Before pupation the full-grown larva abstains from feeding completely and drops to the ground where it prepares a cell out of fallen leaves and soil particles and pupates underneath the soil. The freshly formed pupa is a compact chitinous object and is light brown in colour. The pupal period varies according to the seasonal and soil temperatures, the pupal development during the winter months being slower than during the other periods. The life-history studies conducted during the months of January–February when the average temperature in the room varied from 70°–86° F. is given in Table I.

TABLE I

Showing the development details of D. nerii *in the laboratory*

Sl. No.	Date of egg laying	Date of hatching (1st instar)	2nd instar (1st moult)	3rd instar (2nd moult)	Pupal period	Total days from egg deposition to emergence of adult moth
1	11-1-58	16-1-58	28-1-58	3-2-58	6-2-58 to 18-2-58	37 days
2	do.	do.	do.	do.	8-2-58 to 18-2-58	37 days
3	do.	do.	26-1-58	1-2-58	7-2-58 to 20-2-58	39 days
4	do.	do.	24-1-58	larva dead	..	..
5	do.	do.	28-1-58	6-2-58	6-2-58 to 17-2-58	36 days
6	do.	do.	26-1·58	2-2-58	larva dead	..

Natural Enemies

The writer has recorded *Microplitis* sp. attacking the larva *D. nerii* in Hyderabad State. Ayyar (1938) in Madras has observed *Megarhogas theretræ* V. as a larval parasite of this insect. In Malaya, *Thycolyga sorbillans* Wd. has been recorded on an allied species, *D. hypthous* Cram.

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General and Review Articles

PAPER CHROMATOGRAPHY

By K. M. Aiyappa[1] and C. K. Subramanian[2]

Introduction

Chromatography is an analytical method for the purification and separation of organic and inorganic substances. The merit of an analytical method is reflected in the versatility of its applications. Such is chromatography. No other discovery has exerted as great an influence and widened the field of the organic chemist as chromatographic adsorption analysis. Research in the field of vitamins, hormones, carotenoids and numerous other natural compounds could never have progressed so rapidly and achieved such great results if it had not been for this new method, which has also disclosed the enormous variety of closely related compounds in nature.

Russian botanist Tswett (1903) was the first to be aware of the great potentialities of chromatography and paper chromatography was first described by nobel prize recipients Consden, Gordon and Martin (1944).

Chromatography in essense is an analytical technique for resolution of solutes in which separation is made by differential migration in a porous medium and migration is caused by the flow of solvent. Filter-paper is an ideal supporting column for chromatography, the advantages are its dimension, uniformity, stability, permeability and translucency. Fuller advantage has been taken of the coherence and manipulability of paper in order to detect ultra-micro quantities of materials. For this purpose there are available a wide variety of spot reagents applied with a spray; cutting out for subsequent testing is simpler than with powder columns; radio-autographic contact printing on to a photographic plate may be used where radioactive substances are present; and substances on paper chromatograms may be printed on to a solid culture media for subsequent testing of biological activity with micro-organisms.

Method

A requisite quantity of the solution containing the substances to be separated is spotted by means of a capillary on to a rectangular strip

[1, 2] Citrus Die-back Scheme, Gonicoppal, Coorg.

of filter-paper a short distance from one end. The solution is allowed to dry and the end of the filter-paper nearest the spot is placed in a developing solution usually a water containing solvent (organic) in a closed chamber so that the solvent flows past 'the spot' by capillary action and on down the length of the paper. Paper chromatography functions by a combination of partition, adsorption and ion-exchange. After the chromatogram is run, it is taken out and developed to bring out the spots by a colour reaction. The R_f value of any element or compound is specific for it and is the ratio of the distance moved by its band to the distance of the solvent front. The R_f value is dependent on the composition of the development phase, kind of paper, direction of paper fibres, manner of developing, length of the paper, distance from the starting line from solvent, concentration of solute, presence of interfering substances and temperature of development. Since all these factors can be controlled and kept uniform it is easy to separate a mixture into its constituent parts, identify them and even estimate them fairly accurately.

In the descending method the filter-paper is immersed in a trough containing the solvent and hung in an air-tight chamber. In the ascending method the bottom end of the filter-paper is allowed to dip into the solvent and the filter-paper stands vertically. In the circular paper chromatography the paper is held between two equal sized petri-dishes and a thin tail is cut from the rim to the centre and this tail dips into the solvent in the lower petri-dish. The flow of the solvent in this case is horizontal instead of vertical. A separate paper wick or a capillary tube can also be used for the flow of the solvent in circular paper chromatography.

Uses

Paper chromatography has been an effective tool in the hands of the biochemist in the isolation, identification and structure determination of some of the vast number of compounds synthesised by and occurring in higher plants. Steps in plant metabolism have come to light and more are being unravelled. Chromatography has now been used to study a wide variety of substances of biological interest like alkaloids, glycosides, amines, alcohols, aldehydes, ketones, carboxylic acids and their derivatives, tannins and a wide variety of natural pigments, as well as many of the highly assorted chemical substances included in the groups of coenzymes, vitamins, hormones and antibiotics. The method is exceedingly useful in pharmacological and similar studies. The various analytical operations used in industrial research and routine control of production is made easier, cheaper and quicker by this method. It facilitates in many ways the work

of those engaged in the control of foods and drugs, in clinical laboratories and generally in the safeguarding of the public health, while making more difficult the work of adulterers and other criminals. The dietitian and the food technologist gain by being able more easily and cheaply to assay chemically a wide variety of foodstuffs for their essential constituents and to be able to ascertain the effects on these of processing, cooking, etc. In the hands of the inorganic chemist this technique is especially valuable when dealing with micro quantities of materials. Chromatography has opened new vistas in scientific knowledge.

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BIDI TOBACCO NURSERIES FOR NIPANY TRACT

By K. A. Jalihal*

Introduction

Tobacco is by far the most important cash crop amongst the rain-fed crops grown in Belgaum District of Mysore State. The average return obtained from one acre of tobacco is nearly Rs. 400—the highest for any rain-fed crop.

Being a transplanted crop, the cultivation of the crop necessitates in having nursery areas. The existing method of raising tobacco seedlings in the nursery as followed by cultivators, though not faulty, has enough scope of being improved upon. The existing method, together with the improvements suggested are discussed in this article.

Location of Nurseries

The common practice is to have nurseries in the midst of field where the tobacco crop is to be raised. These are convenient from the point of view of distance. However sometimes when there are no rains, watering of nurseries in fields which are away from water sources would be a difficult job. Even from the safety point of view, the practice is defective, when there are many fields in different corners of the village.

It is therefore suggested that the farmers having many fields in a village should locate the nurseries in one field nearest to the water source to facilitate protection and convenient watering.

Method of Seed-Bed Preparation

The existing method of preparing nursery beds is of two types:

(1) Putting the farm-yard manure in the form of circular heaps so as to form the beds. 10–12 baskets of manure are required for one bed of 4′ in diameter.

(2) Placing tobacco stubbles and stems at the bottom and putting manure on the top of it in the form of bed. It is claimed that this systsm facilitates more efficient drainage than the first method.

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Though both the above methods come under the category of raised seed-beds, they are not sufficiently high. If these are to be prepared sufficiently high according to the above methods large quantities of manure are required. Even in the existing practice with low beds, large quantity of manure is used.

This large-scale consumption of manure can be very effectively reduced by preparing raised seed-bed out of soil and then putting 3–4 baskets of farm-yard manure on the top for every 16 sq.ft. of seed-bed area. Further steps in safeguarding washing away of manure from such beds is to have side protection of old Jowar fodder. This improved method also facilitates easy disinfection of seed-bed as a prophylatic measure, as the entire manure used for the bed can be conveniently treated with fungicide before use.

The economy of farm-yard manure achieved by adopting this method is also noteworthy and is of utmost importance to tobacco growers.

The manure to be used for nursery should be sieved so as to remove impurities like small stones, stubbles, etc. Seedlings make good growth on such sieved manure. 100 sq.ft. of seed-bed area is required for raising seedlings required for 1 acre.

Disinfection of Nursery Beds Before Sowing

It is recommended to disinfect the nursery beds before sowing as a preventive measure against damping off disease. The manure should also be treated with fungicide before use. The best fungicide recommended is Bordeaux mixture 2:2:50. Other proprietary copper fungicides may also be effectively used, in the proportion of 4 oz. for 10 gallons of water.

Method of Preparing Bordeaux Mixture

The proportion recommended is:

Copper sulphate, 2 lb.; Quicklime, 2 lb.; Water, 50 gls.

Fresh quicklime should be used for effective preparation. Metal vessels should not be used for preparing Bordeaux mixture. Copper sulphate should be dissolved in two-thirds of water. Quicklime should be added to the remaining portion of water. Then the copper sulphate solution should be slowly poured into the lime-water, vigorously stirring all the time. Test for the effective preparation is to dip a penknife in the mixture. If properly prepared, the knife will not turn red. If it turns red, little more quicklime solution should be added.

Sowing of Seed

The best time for sowing the seed is in the last week of June or first week of July. No fixed quantity of seed is sown on seed-bed and the cultivators sprinkle the seed by practice.

Many a time the sowing becomes either thick or thin. If sowing becomes thick, it will result in increase of the seed-bed diseases. The seed is mixed with ash before sowing to make up the bulk required for even distribution as the seed is very minute.

It is recommended to use $\frac{1}{6}$ tola of seed for an area of 16 sq.ft.

Covering of Seeds

The local practice is to compact the sown surface thoroughly by pressing either by legs or hands. It is observed that this practice is quite adequate and even with heavy rains the seeds will not be washed away. However as the best safety measure, a cover prepared from bamboo leaves may be used till germination is complete.

Spraying Fungicides in the Nursery

It is a common experience in Nipani tract that the damping off disease is very severe in the tobacco nurseries. The attack is specially serious in years of heavy rainfall during July and early August. The tobacco cultivators though noted for their careful cultivation of tobacco have not so far paid much attention to this problem. The only precautionery measure taken by them in this connection is to sow tobacco seeds at weekly intervals for 2 or 3 weeks, with the belief that if first sown seedlings succumb to damping off disease, the later sowings may escape from its ravages. Though this practice works more or less satisfactorily, there is no guarantee that at least some sowings would be free from damping off. The experience obtained clearly shows that the nurseries need definite precautionary measures against damping off. In 1956 and 1958 the rainfall in July was more than 15″ and as a result, damping off was severe. Cultivators had to obtain the seedlings from the Tobacco Research Station, Nipani, and with some other leading cultivators.

If the seedlings are not of the quality variety, the produce will fetch less. Hence in order to avoid all such complications, it is recommended to spray Bordeaux mixture 2:2:50 or any copper fungicide to the nurseries. The first spraying should be given after 15 days of spraying and then once every week. If the attack is noticed, then the interval should be reduced to 4 days. Thorough soaking of nursery beds with fungicide should be done. The fungicide is best applied with a water can.

Spraying Insecticides

Though the tobacco seedlings are often free from the attack of insects in nursery stage, recently instances have been noticed when the young crop sown after transplanting has been found to be attacked by stem-borer. This shows that the seedlings were attacked by stem-borer in the nursery stage itself and the symptoms developed immediately after transplanting. Hence it is recommended to mix insecticide like Folidol or D.D.T. with the fungicide once or twice.

Invigorating the Seedling Growth

In certain cases when the sowing is delayed or basic manure is inadequate, the seedling growth may be stunted and they may not be available for transplanting in proper time. Under these circumstances the seedling growth may be improved by application of ammonium sulphate to nursery beds. The quantity of ammonium sulphate that may be applied to a bed 16 sq.ft. is 1 oz. dissolved in $\frac{1}{2}$ gallon of water. Immediately after application of ammonium sulphate, the seed-bed should be throughly watered so that the seedlings will be free of ammonium sulphate solution if any on the leaf surface. Some cultivators believe that seedlings treated with ammonium sulphate will not withstand transplanting specially on sunny days and the stand in the field will be poor. However this will not affect the seedlings transplanted in August as the highest temperature in August is generally not more than 70–74° F. and it may only affect the transplanting done in September.

Seedlings raised in the manner stated above will be ready for transplanting in 4–5 weeks. The earliest opportunity should be taken to transplant the seedlings after they are ready. The seedlings should not be allowed to grow tall in nurseries. Thick sowing makes the seedling grow taller and these seedlings do not establish well in the field and also are unsuited for lowering the bottom leaves.

An experiment was conducted at Nipani Tobacco Research Farm to find out the optimum age of seedlings to be transplanted. Seedlings from 4 weeks to 10 weeks of age were transplanted. It was found out that seedlings up to 6 weeks can be transplanted with advantage. If older seedlings are planted, the yield will be less.

During 1957–58, a seed-bed trial was conducted at the above Research Station comparing the local method of raising seedlings with the improved method. The methods were as follows:

(*a*) *Local method.*—(1) No spraying of fungicides. (2) No side cover to seed- beds. (3) No top cover till germination.

(*b*) *Improved method.*—(1) Regular spraying of fungicide. (2) Side protection to seed-beds with Kadbi. (3) Top cover till germination.

The results were noteworthy. Nearly half the seedlings in the local method succumbed to damping off while the seedlings in the improved method were quite healthy.

Summary

1. Seed-beds for raising tobacco seedlings should be as close to the water source as possible.

2. Instead of preparing the entire seed-bed with farm-yard manure it is quite adequate if 3–4 baskets of farm-yard manure is put on each raised bed of $4' \times 3'$ and sides of beds protected with dry jowar stalks.

3. The manure to be used for nursery should be disinfected with fungicide like Bordeaux mixture 2:2:50 or any proprietary copper fungicide.

4. Seed should be sown at $\frac{1}{6}$ tola for 16 sq.ft. area.

5. Fungicide should be sprayed after 15 days of sowing against damping off and then at weekly intervals.

6. Mixing of insecticides like Folidol will be helpful in preventing insect infestation of leaf-eating caterpillars and stem-borers.

7. Fertilisation of the seed-bed with ammonium sulphate will be useful if the seedling growth is stunted.

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A SHORT REVIEW ON THE CHILLI LEAF-CURL COMPLEX AND SPRAY PROGRAMME FOR ITS CONTROL

By Dr. M. Puttarudriah*

The chilli plant suffers from several types of maladies manifested on the leaves, all of which are known by the cultivators by the vague popular name—"murda" in the local language in parts of Mysore State, meaning literally the curling of leaf-margins. This leaf-curl complex is very common and severe, occurring in all the chilli growing areas of the world—Spain, Bulgaria, Italy, Puerto Rico, Russia, Java, U.S.A., India, Ceylon, Brazil, South Africa and other countries.

I. Nature of Damage

The leaf-curl complex consists of several types of manifestations, *viz.*, dark green mottling and crinkling as in Spain; mosaic like the cucumber mosaic as in Bulgaria and Italy; mottling, stunting and malformation of fruits as in Puerto Rico; Chlorosis along the edges of apical leaves reduced to boat shape as in parts of Russia; curling of leaf margins, with roughened lamina, great reduction of the leaf size, vein clearing, etc., as in India, Ceylon, South Africa, U.S.A. and Brazil.

II. Causes for Occurrence and Spread of "Murda" (Leaf-Curl)

The manifestations of "Murda" are of two categories:—

(i) Some manifestations of "Murda" are caused by thrips and mites due to their sucking the sap from the leaves.

(ii) Other manifestations of "Murda" are caused by the several viruses, carried by the vectors—the two aphids *Myzus persicæ* and *Aphis gossypii*, the two white flies—*Bemsia tabaci* and *B. inconspicua*. The malady noted in parts of Russia is known to be caused by the Coccid Bug *Hyalesthes obsoletus*.

The leaf-curl and roughened lamina are caused by the Thrips—*Scirtothrips dorsalis* and the mite—*Hemitarsonemus latus*. The thrips and the mites were suspected to carry the virus but experiments have proved that they are incapable of transmitting them, nor are they caused by the soil borne factors like the *Nematodes* and root diseases.

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So there are three species of insects and a mite involved in the leaf-curl complex. The two species of aphids and the two species of white-flies are the vectors of some virus diseases, whereas the thrips and the mite induce the leaf-curl and roughened surfaces by feeding on the leaf sap and are not known to spread any virus. So it is very necessary to distinguish between the thrips and mite caused leaf-curl and the virus caused leaf-curls. The popular name "Murda" must be used in a restricted sense to denote the former type only.

In Mysore State the leaf-curl complex involving the thrips and mite and the viruses is common, but extensive and detailed field-observations in several parts of chilly growing areas have shown that it is to a very large extent thrips and mite caused leaf-curl; and in rare cases the virus caused maladies.

These different types of symptoms as between the insect and mite leaf-curls and virus leaf-curls and also between the thrips damage and the mite damage can be made out by extensive and close examination of affected plants in the fields. It becomes easy with experience.

The thrips cause pronounced leaf margin curls dorsally and the insects can be seen under a lens within the curls of affected tender leaves. They are likely to desert the older leaves after damage. The mite causes more roughened, brittle lamina with yellowish tinge and margin curls. In the case of virus caused symptoms, no thrips or mites nor the margin curl or rough surface are seen. There may be reduced leaves with crinkling and yellowish tinge, with vein-clearing.

III. Control Measures

Several insecticides have been tested against the leaf-curl Complex. Thrips and mite induced leaf-curls are controllable with insecticides, but not the virus diseases. But it may be possible to control the insect vectors of the virus diseases, by the same insecticide used against the thrips and mite on the chilly plants and several other alternate hosts which may harbour the vectors. What is very necessary is to practice preventive treatment as no curative spraying after the leaves are curled up would be of any avail. Together with this, some essential cultural practices like cultivation of other solanaceous crops such as tomato, etc., away from chilly plots or in strict rotation; destruction of crop residues after the last harvest of chilly crop and clean cultivation, with application of insecticides from the stage of nursery itself, are very necessary.

Parathion, Endrin and 50% B.H.C., W.P. have all been found to be effective on thrips and mites and the insect vectors. As the leaf-curl involves the mite and also chillies suffer from mildew, an insecticide

in combination with sulphur would be ideal for the preventive sprays. On demonstration basis the preventive treatment with Parathion (Folidol) or 50% B.H.C., W.P. was taken up in several places of the State and the leaf-curl was effectively controlled. Some growers too who followed the spray schedule strictly were convinced of the efficacy of such preventive spraying.

The following is the spray schedule and any of the abovementioned insecticides with wettable sulphur may be used.

Spray schedule with Folidol E-605, 46·7% and Wettable Sulphur against Chilli leaf-curl

	Stage of crop	Formulation	Dosage/Acre	Remarks
1	*Nursery seedlings* 15–20 days old	Folidol 0·02% and wettable sulphur 0·16%	About 1 gallon of mixture will suffice to treat the seedlings required for one acre, *i.e.*, to treat 3 seed-beds of the size 25′ ×3′ or 2′	2 c.c. of Folidol + ¼ oz. of wettable sulphur in 1 gallon of water, *i.e.*, 2 oz. (12 tea-spoonfuls) of Folidol and 1 lb. wettable sulphur in 60 gallons of water
2	*Nursery seedlings* 30–40 days old	do.	1½ to 2 gallons of mixture will suffice to treat the seedlings required for 1 acre	do.
3	*At the time of transplantation*: Seedlings removed from the seed-bed for transplantation	do.	do.	do. Seedlings to be dipped from top till root region in the mixture or it may be sprayed previously
4	*After transplantation*: In the field once a month for four months (4 sprays)	Folidol 0·05% +wettable sulphur 0·16%	About 40–60 gallons of mixture required per acre depending upon the size of plants in the field	5 oz. of Folidol (30 tea-spoonful) and 1 lb. of wettable sulphur in 60 gallons of water

In place of Folidol any phosphatic compound may be used in the above proportion; or 50% B.H.C. may be used at 3 lb. of B.H.C.+ 1 lb. of sulphur in 60 gallons of water. All the chilli growers should carry out these treatments, to fight this malady with a united front.

Experimental work in this connection is being persued.

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A BRIEF REVIEW OF THE WORK DONE AT THE AGRICULTURAL CHEMISTRY SECTION BANGALORE, FOR THE 10-YEAR PERIOD FROM 1948 TO 1958

By S. S. Sirur*

Introduction

The work of the Chemistry Section is fully reported from year to year in the annual reports of the Section and of the Department and the results of practical importance together with recommendations to farmers have been published from time to time in bulletins and leaflets. In addition, the results of scientific interest are published in the form of articles and papers in scientific journals published both by the Department as well as outside agencies.

The work of the Section as a whole or the results of specific items of investigations have also been occasionally reviewed in order to assess the progress achieved. In this connection reference may be made to two reviews of the Section's work, the first by B. Narasimha Iyengar[1] published in the *Journal of the Mysore Agricultural and Experimental Union* and in the second by B. T. Narayanan[2] in the *Mysore Agricultural Journal*. The objectives of the Section, the main lines of work undertaken and the important results achieved on various aspects have been described in the reviews. The latter review in particular may be taken as more or less indicating the stage of progress immediately preceding the present review.

The main object of the section may be stated to be the application of chemical science to problems of agriculture for its improvement and development. In pursuance of this object, the following lines of work constitute the main programme of work and activities of the Section. It may, however, be pointed out that the scope and volume of work and the actual progress achieved under each item during a particular period is defined according to the urgency of the problem at the time and also according to the resources which may be available for the purpose.

Research

(1) Surveys for classification and characterisation of soils; other soil studies bearing on their fertility and crop-producing potential,

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(2) Soil and water conservation research, (3) Studies on soil-crop relationships involving the fertility status of different soils and the nutrient requirements of crops for formulating manurial schedules and soils amendments, (4) Studies of different manures and fertilisers and their effects on soils and crops, (5) Studies on methods of application of fertilisers for their efficient utilisation, (6) Study of the composition and quality of agricultural products, (7) Conservation of wastes and by-products of agriculture and their economic utilisation, (8) Chemical and biochemical aspects of crop production and protection.

Agricultural Education

As an activity closely allied with research and extension, the Section in common with other scentific sections has been entrusted with teaching of Agricultural Chemistry at the Agricultural School and Agricultural College, Hebbal.

Advisory and Extension Work

In connection with the work of other branches of the Department or with current problems of cultivators, the Section has to undertake the routine analysis of various agricultural materials such as soils, manures and fertilisers, irrigation waters, foods and feeding stuffs, dairy products, insecticides and pesticides, etc.

The Reorganisation of States which occurred during the latter part of this review period may be referred to as in important event which has greatly increased the scope and extent of the activities of the Department. Apart from the necessity for reorientating the work of the Sections to meet the needs of a greatly extended area, it has also become necessary to deal with new and varied problems which have arisen or demand more attention. The most important of these is research on soil and water conservations and soil reclamation which require urgent attention in the dry tracts which form an extensive area in the new State. In this review, though the work of the Chemistry Section of the erstwhile Mysore State is mainly dealt with, the work of its counterparts in the States from which areas were merged into the Mysore State has also been referred to so that the background of the present position may be clearly understood. It was necessary to assess the overall position regarding the past achievements as well as the problems which at present confront the enlarged State in order to formulate the lines on which the future work has to be undertaken.

Soil Investigations

Up to the beginning of the review period, an appreciable amount of work had been carried out on studies on the important soils of the

State and on Soil Surveys for specific purposes, mainly for crop-planning under irrigation, *e.g.*, Soil Survey of Visvesvaraya Canal Area, Survey of Lands in Vani Vilas Sagar and so on. During the period of review, apart from soil studies incidental to investigations on crop-responses to treatments and a few minor surveys, no major soil-classification work was undertaken. However, the available soil and agronomical data was furnished to the All-India Soil Survey Scheme, under which the soil work carried out in all the States was compiled and the soil map of each State was prepared and published in its final report in 1952.[3] In 1956, after the formation of the new State, a new soil map has been prepared by the Section, mainly from the data given in the above report and also from data subsequently collected in the Agricultural Departments of the merging States. This map has been adopted as the official map and published in *Mysore State in Maps* prepared by the Statistical Department. The seven broad groups into which the soils of the new State are classified and their important characteristics have been described by Sirur.[4] A general review has also been made of the resources and problems of the soils of the enlarged State by Sirur[5] in an article which is under publication in the *Annual Magazine of the College of Agriculture, Hebbal.*

With regard to soil and water conservation research, the importance of this subject in the Old Mysore State was stressed in 1951 by Mr. Ford M. Milam, Technical Specialist assigned to the I.C.A.R., New Delhi, who took up an inspection tour in May 1951 and drew attention to the serious damage to farm lands and to the silting up of irrigation tanks due to soil erosion. Mr. Milam accordingly made certain recommendations for taking up comprehensive soil conservation programmes for control of soil erosion. In this connection the problems of New Mysore State and possibilities of work and achievements have been described by Sirur.[6]

With respect to research on water conservation which is closely allied with soil conservation, the problem has attracted a great deal of attention and has been the subject of considerable investigation in other States where it was more acute. Several Research Stations dealing with specific aspects of dry farming for *kharif* and *rabi* crops and soil reclamation have come over to Mysore State, notably from the Bombay Districts of Belgaum, Bijapur and Dharwar. At present three Research Stations which are carrying out active work on the problems and located at Kaladgi (Bijapur District), Saundatti (Belgaum District) and Nargund (Dharwar District) together with the Soil Reclamation Section at Dharwar Agricultural College are attached to the Chemistry Division under its control and guidance. The work was started on a co-ordinated basis under the Soil Physicist's Section in Bombay State in 1951 for

working out improvements in the Bombay Dry Farming Method. The main indications were incorporated in the *Rabi* Campaign of 1958 *vide* "Step up your production through soil and water conservation and judicious manuring" by S. S. Sirur[6] in the *Rabi Production Campaign Bulletin*, 1958. Similarly the results of investigations on the improvement of cotton yields in the Karl (alkali) soil by agronomical adjustments and soil amelioration were presented at the Ninth Conference of Cotton Growing Problems at Dharwar during December 1958 and were recommended by the Conference for adoption by cultivators—Sirur *et al.*[7,8]

Mention may also be made of the Scheme for Demonstration of Dry Farming Methods, on cultivators' fields on the basis of guarantee of compensation to the cultivators in case of loss if any which was formulated by the Soil Physicist to Government, Bombay State, based on the investigations on dry farming. The Scheme is at present in operation in the erstwhile Bombay Karnatak Districts of Belgaum, Bijapur and Dharwar.

Studies on Soil-Crop Relationships and Manurial Requirements of Crops

This has generally formed the major item of investigation of the Chemistry Section and, particularly during the last decade, numerous investigations have been in progress on this aspect. Following the previous investigations which were carried out in pot-culture, natural soil-cisterns and field experiments on the manurial requirements of important crops of the State, the work was continued with particular reference to field investigations at different Research Stations in the State. The work also demanded particular attention in connection with the general drive for increasing agricultural production following the shortages of food and raw material after the Second World War.

The results of these entire works have been published for adoption in current agricultural practice by S. V. Govindarajan,[9] in Bulletin No. I, Chemistry Series, 1955, as manurial formulæ for the Principal Crops of Mysore State. These recommendations have been advocated to the cultivators as the official recommendations of the Department. The manurial recommendations for paddy was also adopted in the campaign for Japanese Method of paddy cultivation. The manurial doses have been adopted in the Fertiliser Demonstration trials which have been taken up by the I.C.A.R., in all the States and which have been in progress in Mysore State since 1954–55. The I.C.A.R. has published the reports[10] of the results of these trials for 1954–55 and 1955–56. The results for Mysore State, giving the yield data for paddy

for the years 1954–55 and 1955–56 in the different villages and taluks where the demonstrations were laid out have been published by K. L. Bhatta,[11] Regional Officer, Fertiliser Demonstration Scheme, in the *Information Bulletin*, Department of Agriculture. A review of work on the present position of fertiliser requirements of crops in the State and its allied aspects has also been published by Sirur[4] in the *Mysore Agricultural Journal.* With particular reference to paddy cultivation the work has been reviewed in an article under publication in the *Mysore Agricultural Calender for* 1959 by Sirur and Venkata Rao.[12]

Another important activity which is financed by the I.C.A.R. and placed under the Agricultural Chemists of States for implementation is the setting up of Centres for carrying out Model Agronomical Experiments with fertiliser application as an important item. A centre for experiments on paddy was started at Veerapura originally under the T.C.M. Aid which was subsequently shifted and started under I.C.A.R. at Hosahalli near Shimoga from 1957–58. A second centre which was started in Hyderabad State at Gangavathi in Raichur District for irrigated Jowar and cotton is also now in Mysore State. The results of the Experiments would be available in due course.

Along with the Model Agricultural Experiments and closely co-ordinated with them is the Scheme for Simple Fertiliser Trials on cultivators fields which is also entrusted to the State Agricultural Chemists for implementation. The Scheme was started in 1958–59 and envisages the laying out of fertiliser trials of various kinds on cereals, legumes, cash crop and oilseeds in representative zones of 12 districts which have either assured rainfall or irrigation facilities. The results will be reported in due course.

Mention may also be made of Simple Fertiliser trials on cotton which was sponsored by the Indian Central Cotton Committee and were conducted in the rainfed cotton areas of the Bombay Karnatak Districts from 1954–55 by the Agricultural Chemist, Bombay State. Subsequently in 1957–58 they were continued by the Mysore Agricultural Department and have given valuable indications in the manuring of cotton.

It is expected that with the help of the past work as well as the work which is yet to be taken up, substantial progress would be achieved within the next few years with regard to the recommendation of fertiliser use for different crops under different soil and climatic zones of the State.

Studies on Fertilisers and Methods of Their Application

The subject of different fertilisers and methods of application for their efficient and economic utilisation has also been engaging consi-

derable attention of the Chemistry Section. The balanced application of different manurial constituents has been throughout kept in view by the Section in advocating fetiliser recommendations. In particular the interrelation of organic manures and chemical fertilisers is much in the forefront at present and a recent article by B. V. Venkata Rao[13] in Kannada in the *Mysore Vyavasaya Patrike* has proved to be very popular among cultivators and National Extension Blocks.

The application of phosphates and its proper utilisation by the crop is beset with difficulties on account of its being "fixed" and rendered unavailable both in acid and calcareous soils due to its conversion into insoluble forms. The Section has therefore given particular attention to this problem and carried out a number of investigations.

For the paddy crop, investigations have shown that this difficulty can be overcome by the application of the required dose of superphosphate to a suitable green manure crop[14] grown previously. As the application of green manure is a common practice in paddy cultivation, this method is found not only to increase the yield of the green manure crop but also in rendering the phosphate application more effective, thereby resulting in a double advantage. For other crops such as cereals and sugarcane, the method by "band placement" by drilling the superphosphate or applying it through a tube attached behind a plough at a depth of 3–6 inches below the soil surface has shown good benefit. Another very effective method of increasing the availability of applied phosphates which was worked out by the Section is the addition of superphosphate either along with farmyard manure, or preferably after composting it with a suitable quantity of farmyard manure for a period of about 3 weeks to 1 month. This practice is considered to be effective because of the conversion of the phosphates into organic form which do not get fixed in the Soil and gradually become available to the plant. Experiments carried out on paddy and ragi[15] at the Agricultural Research Station at Nagenahalli, Hebbal and Ramakrishnapura have shown positive responses to applications of phosphates in this manner as against the usual method of broadcast application of the fertiliser.

Working out the optimum time of application of fertiliser so that there is maximum utilisation of the nutrient constituents making for an increased crop yield an important factor is the maximum utilisation of the manures by their distribution at times of actual nutritional requirements of the crop. Experiments[16] carried out at various Agricultural Research Stations on the time of application of ammonium sulphate to paddy have shown that best results are obtained when the same is applied in divided doses, one at planting and the other at 4

weeks after transplanting of paddy to synchronise with the operation of first weeding.

In trials of new fertilisers which have become gradually available, the Section carried out comparative trials regarding the efficacy of ammonium nitrate, urea, ammonium sulphate, nitrate and others. Except for particular difficulties such as running into liquid due to high moisture absorption or the possibility of being leached out quickly due to their high solubility, in actual effect they were on the whole comparable to ammonium sulphate in their manurial value. With regard to phosphates, no other form has been as prevalent as superphosphate, but application of benemeal or rockphosphate was found to be advantageous in acid soils.

Particular mention may be made of the trials for applying liquid (anhydrous) ammonia direct to the soil as a nitrogenous fertiliser. This practice has been extensively developed in other countries, particularly in the U.S.A. but has not been much in vogue in this country. Experiments showed that this material could be successfully applied to crops like paddy, ragi and sugarcane. The loss in applying it was found to be negligible and the manurial effect was equal to that of sulphate of ammonia. A suitable type of applicator was also designed for use under local conditions.[17'18] If the material could be made available in larger quantities and facilities for storage and transport provided, there is great potentiality for its use on a wider scale at least in areas under intensive farming with irrigation where there is scope for large-scale use of fertilisers. The use of ammonia directly as a fertiliser would thus obviate the necessity of converting it into ammonium sulphate whose manufacture usually suffers from the difficulty of lack of adequate supplies of sulphur or calcium sulphate and would also prove to be ultimately cheaper.

With regard to the possibility of a steady supply of phosphates by keeping up soil phosphate at a high level an experiment was carried out in natural soil-cisterns for the yearly application of increasing doses of phosphates upto 140 lb. per acre for eight years. The residual effect on crops of sunn-hemp and ragi showed that there were increases in yields up to the 80 lb. application of phosphate and also better utilisation of the added nitrogen. The soil analysis also showed appreciable increases in available phosphate.[19]

Application of green manure is a common practice in paddy cultivation in the State. A dose of 3,000–6,000 lb. of green leaf manure is generally applied 2–3 weeks before planting of paddy. A study was conducted at the A.R.S., Nagenahalli, to ascertain whether it would be advantageous to apply higher doses of green manure than the

nominal dose and it is found that doses higher than 9,000 lb. are not beneficial and a dose of 3,000–6,000 lb. as a basal dressing seem to be optimum.[20]

Conservation of Wastes and By-products of Agriculture

In the context of application of the farm wastes such as cattle excreta, farm litter, etc., converted into farmyard manure or compost, both for increasing the crop yields and maintaining the soil fertility, the conservation of such wastes and improvements of their quality is of great importance. The Section has been carrying out work on this aspect and has made efforts for popularising methods worked out here and elsewhere for the proper storage and preservation of farm wastes. Govindarajan[21] published these improved methods in Circular No. 59 of 1949 entitled "Composts, their importance and their manufacture". The Department has been popularising these methods and a special scheme was launched for the preparation of town composts and has been in progress for several years.

Among other products, the improvements of jaggery received much attention and investigation. In addition to working out of actual methods of preparation of high quality jaggery and boora sugar, the Section undertook the manufacture of activated carbon from sawdust and paddy husk for use in preparation of white jaggery. The manufacture was in progress at the V.C. Farm till 1950 when it had to be discontinued as the prices of jaggery were very low rendering it unprofitable for cultivators to incur any additional cost in the manufacturing process. The work of the Chemical Section in the development of Sugarcane and its products has been described in an article published by Sirur[22] in the *Mysore Agricultural Calender*, 1958.

Recently a Scheme for determination of properties and factors responsible for grading of "Gur" (Jaggery) for taking up measures for its improvements has been introduced by the Indian Central Sugarcane Committee in all States and has also been taken up in Mysore under the Agricultural Chemist.

Chemical and Biochemical Aspects of Crop Production and Crop Protection

As has been pointed out by Narayanan in his review[2] the Section, dealing as it does with all aspects of soils and crops, is the co-ordinating and co-operative centre of most activities of the Department. It not only helps the Botanist to assay the quality of crops produced by him and in grading the varieties, but likewise assists in the work of the Entomologist and Plant Pathologist in the analysis of products which are concerned in their work.

Considerable work on the investigation of insecticides and pesticides particularly with regard to the preparation of non-poisonous insecticides from indigenous plant substances, *e.g.*, the Hongey oil Resin Soap, was undertaken by the Section in the past.

During the review period, the chemical or physiological aspects of certain diseases were taken up for investigation. The Scheme for investigation of Hidimundige Roga of Arecanut palms was sponsored by the Section and was started from June 1954. The disease is believed to be physiological in nature due to the lack of certain micro-nutrients or excess of some of them leading to toxic conditions. Analysis of affected plants and of the soil is being carried out as well as field trials of application of selected micronutrients to study their effects in controlling the disease.

The Scheme for investigation of Powdery Mildew on tobacco is another Scheme in which the chemical analysis is carried out on tobacco leaves which are treated with different fungicides for control of the disease, inorder to determine their effect on the quality of tobacco. The chemical work pertaining to the Physiological Scheme on Egyptian Cotton at Mandya for investigating the low yields and peculiar physiological behaviour of the plants is also being carried out under the guidance of the Section.

Soil Reclamation and Amendments

Among soil conditions which may inhibit optimum crop growth, soil acidity and alkalinity are two prominent factors which had to be contended with in the State. The former is prevalent in areas of high rainfall which causes leaching out of bases and the latter in areas having black soil with low and uncertain rainfall where there is accumulation of salts in low-lying areas due to their incomplete removal in drainage water.

Both these factors have received attention in the work of the Chemistry Section. The correction of acidity by application of burnt lime for paddy and plantation crops such as Coffee and Areca has been advocated but the problem has been one of inadequate supplies of lime in these areas. Experiments carried out at the Rice Research Station at Mangalore have also definitely shown that application of 1,000–2,000 lb. of lime per acre for 3 years over the usual doses of 4,000 lb. of green leaf neutralised the acidity and resulted in increased yields of paddy. Measures for procurement and transport of required quantity of lime are necessary and recommendations have been made for subsidising the import and distribution of agricultural lime to cultivators for a minimum area in each year. It appears that the appli-

cation of 500 lb. of quick lime per acre may be economical which should, however, be repeated once in 3–4 years.

With regard to the problem of salinity and alkalinity which was observed to be prevalent in the northern district of Chitaldrug and some adjacent areas of the Old Mysore State, experiments were carried out at the Babbur (Hiriyur) Farm located in that district. Measures for the application of heavy doses of farm-yard manure and green manure in moderately affected lands and gypsum in more advanced conditions were advocated. A soil survey of the areas under command of the Vani Vilas Sagar[23] was carried out for a better crop distribution and restricting the cultivation of paddy for keeping this problem under control.

With the formation of the New State the problem has become much more extensive and acute due to the addition of areas of low rainfall from the erstwhile Bombay and Hyderabad States which are also similarly liable to the occurrence of salinity and alkalinity on a large scale. The problem is particularly difficult to encounter in the absence of adequate supply of water for washing out the salts and for other methods of reclamation involving the application of chemicals.

However, in view of the urgency of the problem, a beginning was made by the Bombay State to tackle the problem of reclamation of a typical alkali soil known as "Karl" soil occurring extensively in the districts of Dharwar, Bijapur and the eastern part of Belgaum Districts. In the absence of irrigation the problem had to be dealt with under conditions of low rainfall with the help of dry farming methods. A special scheme was in operation at the beginning and later the work was included as a part of the Soil Physicist's Section at Sholapur. Since 1951, the investigations were carried out on co-ordinated basis at the Agricultural Research Station at Nargund in Dharwar District. Promising results of increasing the crop yields of jowar, cotton and wheat have been obtained by adjustments of the agronomical operations under moderate conditions of alkalinity and by application of small quantities of sulphur or gypsum for more acute conditions.

There are also other conditions of high salinity accompanied by stagnation of water in rainy season in bread and flat valleys where water movement is greatly impeded, leading to the development of marshiness. All these conditions call for concerted action for surveying these lands for demarcating areas of different degrees of salinity and preparing plans for undertaking reclamation. It is proposed to make a beginning in this direction by undertaking surveys primarily in the northern districts of the State for lands mainly in tank *atchkats* and preparing

plans and estimates for reclamation measures to be taken up in each area. A special scheme has been preposed for this purpose and it may be possible to take up pilot projects for reclamation on the basis of the survey.

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THUS SPEAKETH WATER

By B. R. N. Iyengar*

From vast watersheets up sucks God Sun,
To be serviceable busily sends me down,
And fill the Nation's barns with splendid corn,
And thus keep the Nation jolly every morn.

Droppeth in drizzles or droplets from heaven,
Like cats and dogs do I pour down even,
And when I descend down as rain,
I bring thread and thrum in my train.
But if with care greets me every gay swain,
Assure I would I bestow delightful gain,
Leaving no occasion for Nation to constrain
Where and how to procure enough grain,
Or bother to fertility fall regain,
In the face of population multiplication.

Soil thirst, no doubt, I gladly assuage,
When conveyed in proper carriage,
But, in no age, listen, on an average,
Responded have I with ill or nil drainage.
Farmer-friend, so fail not to arrange
Drainage adequate in your Acreage.
For I hesitate not to be a scourge
If I've'nt free straight passage.
Son of the soil, so need you courage
To work me for your advantage.

Irrigation they hail, 'welcome irrigation
A boon veritable to clod-hopper's nation'.
Welcome some with great jubilation,
Some put me under suspicious observation,
Favour as I kindly peasants some,
And disfavour some and make irksome,
Implanting great consternation
In the minds of Rulers of the Nation.

* College of Agriculture, Dharwar.

Note am I water of course,
But ere, test well, wetting furrows,
For when I allow all that hide to wish,
Which as pabulum I so much relish,
Mistake me not as ever selfish.
For alone never am I found on earth
Save in laboratory chemistry of worth.
Listen, loaded if I am with saline
I am very much feared to spell ruin,
And no less unkind too, if alkaline.
Beguiled be not at my placid appearance,
For all is not milk that from cow comes.
I may be with salines enriched,
When certain you would be pitched
gainst impoverishment sure and gradual,
By the agents destructive detestable.

Friend of lotus also is friend of me,
Assists as he to concentrate me,
But strengthened when I am so,
Enemy deadly I transform *facto ipso*.
Beware, therefore friend, one's friend
Will to another be of inimical trend,
Which normally is hard to mend,
Which wisely be avoided should
As a slanderer or scorpion you would.

Flow if I, on and on, in continuance,
Beware w'ld I be unfailing nuisance.
For in soils sticky, I waterlog
Create eventually a certain bog
And permit not even a useless log.
Heed, hence, to once get me sennightly,
And if necessity so needs it cropwise,
Call interval be adjusted otherwise,
So Nation's crops may prosper luxuriantly,
And fill the granaries overflowingly,
And make them, ever and anon, the cornucopia,
Indeed a dire need for Mother India.
Pray, hear and heed my idiosyncrasies,
Which include some special delicacies,
Of which one is dirty organic matter,
Which forget not to freely scatter
On the holy floor of terra mater,

If her children have to grow fatter,
And be her protectors vigilant, valiant,
For, it plays the police to subdue defiant
Fields and render my passage emollient.

Soil saviours scold, scorn when I curdle,
With dislodgeable clay and trundle
On the Mother Earth all so fondle,
Down to the oceans deep cradle,
When Ma is unbedecked of bunds girdle,
Leaving gaping ghastly vales,
To relate sorry arresting tales
Of fields ere were healthy and hale,
Shaking mighty men's solid morale.

Lo, Nation's food store is my fast friend,
To give company when I roll along ground,
If with organic cement it's unbound,
One can't prevent me befriend,
Nor can hold my friend behind,
For with friend I traverse dauntless
Planned, proper mends are put unless,
And inter, too, organic debris not less.
Leave not the land vegetationless,
For it will show y're careless,
And unhindered I shall happily trespass.
Not merely this. My scouring is so stealthy
That none can spot, see or stop easily,
As I push level land ruthlessly low
For me in storms to joyously flow
And let the Nation receive serious blow
Recovery wherefrom is costly and slow.

Through narrow unguarded cleavage
In bunds, mends or earthen barrage,
I can elude away through seepage,
Counting ultimately a weighty wastage.

Secretly I tell you 'am afraid damn
Of bunds bedded with good grass,
For dense grass is difficult to cross.
Hence, condemn not bunds and grass
If with lands you long to live calm.
It's they that easily lay salt on my tail,
And into soil force me without fail,
And hence grassed bunds a great avail.

Ignore bunds if you, and simply recline,
Your only lot will be to repent with pain,
But stitch in time saves nine,
To memorise is truly wise and fine.

It's they who can't know B from battledoor,
That would reject this as a rigmarole,
And in the Nation play destructive role.

From vast watersheets up sucks God Sun,
To be serviceable busily sends me down,
And fill the Nation's barns with plentiful corn,
And preserve the Nation jolly every morn.

MEANINGS

Cornucopia—Horn of plenty. *Thread and thrum*—Good and bad together. *Assuage*—Lessen. *Pabulum*—Food. *Ipso facto*—In the fact itself, virtually. *Sennightly*—Weekly. Inter—Bury. *Easily lay salt on one's tail*—To catch. *Can't know a B from a battledoor*—To be thoroughly ignorant. *Rigmarole*—Idle talk.

[We regret to annouce the demise of Sri. B. R. N. Iyengar at Dharwar on 20 th August 1959.—*Ed.*]

News & Notes

Fifth National Convention of Farmers, Mysore, 1959

One of the advisers to the All-India Farmers' Forum laid stress on the farmers having to develop a sense of belonging with reference to their organisation. It is rather difficult to grasp the full implication of the term. But when it was decided to hold the 5th National Convention of Farmers at Mysore, Mysore rose to the occasion and about 4,000 farmers from all over India went over to the big meeting held in the first week of May 1959 in the Mysore City, the truth of the fact that the farmers had developed a sense of belonging, was unmistakably evident. The Mysore Farmers' Forum arranged for all the setting necessary for the congregation.

The Fourth Convention of the All-India Young Farmers' Association was also held simultaneously with the Farmers' Convention and it lent colour to the total programme.

Between the general setting and the passing of the few resolutions which have been produced here, the Convention had a four-fold programme of the Exhibition, the Commissions, the Commodity Committees and the General Conferences. The first day's proceedings commenced with the holding of the Commodity Committees, which even though it might not have been so evident to the onlookers as to those involved was clearly indicative of the fact that the Farmers' Forum knew that its business was its main prop.

Inaugurating the Convention, Shri Mangaldas Pakvasa, Governor of Mysore, said that the producers of food should not be allowed to suffer in any way. That even the Governor should have complained that the farmer and the consumer had suffered at the hands of the middlemen, indicates how serious this middlemen problem is. It also enunciates a common cause as between the producer and the consumer. In addressing the valedictory session Shri Thimmareddy, the Minister for Agriculture, Andhra, was very emphatic that in the Third Plan the Agriculture Sector programme should be framed in villages and not in Delhi; and he was sure that if Government met all their requirements, the farmers would not only be able to feed 40 crores of people but even 120 crores of people.

Shri A. P. Jain, the Union Minister of Agriculture, in his address to the session of the Farmers' Forum Council, declared that the Congress

had decided that the foundation of Village life should rest on three pillars, namely the Panchayat, the Co-operative and the School.

In opening the Exhibition, Shri B. D. Jatti, Chief Minister of Mysore, said that living on land was becoming more exciting and challenging in view of the fact that with all the new discoveries available for use it was estimated that two out of three children in the world went to bed hungry. He concluded that the farmer had to be a good economist.

The Agricultural Committee under the Chairmanship of Dr. P. S. Deshmukh laid stress on soil conservation and building up of soil fertility and irrigation and water economy. The Animal Husbandry Committee under the Chairmanship of Shri Ch. Brahma Prakash, President, Delhi Krishik Samaj, came to the conclusion that the two serious problems in the farmers' life were that of middlemen and the procurement of food for animals. Shri Ch. Brahma Prakash presided over the Co-operation Committee also which was further addressed by Shri M. V. Krishnappa, Union Deputy Minister of Agriculture. The Committee concentrated its attention on Service Co-operatives.

The Commodity Committees drew attention to certain salient points. Plantation Crops Committee (President: Shri K. P. Amrithnath Iyer, Working President, Kerala Farmers' Forum) laid stress on storage facilities and warehousing at Panchayat and Taluk levels. Fruits and Vegetables Committee (Presidnet: Shri H. G. Patil of Bombay) pleaded for liberalising import of Potash fertilisers and having Farmers' Forum representatives on Marketing Committees. Tobacco Committee (President: Shri R. I. Amin of Bombay) recommended fixing of Income-Tax not on acreage but on income basis. Sugarcane Committee (President: Shri J. P. Nanda of Orissa) recommended the fixing of prices taking into consideration the cost of production of cane and cane-sugar and bringing into existence of co-operative sugar factories. Oilseeds Committee (President: Shri Satwant Singh of Punjab) was for establishing co-operative crushing plants and complete banning of oilseed exports. The Cereals and Pulses Committee (President: Shri V. N. Kak of Rajasthan) pleaded for the simplifying of procedure of granting loans to farmers.

One of the points of frustration felt by the farmers at the Convention was the question of language. Delegates generally agreed that this difficulty would be there in the very nature of an all India Convention. This difficulty would be overcome by holding regional conventions where there would be no language problem, preceding the all-India Convention. In a previous Convention held at Delhi a solution was attempted in that the delegates from different provinces were

requested to meet and formulate points to be brought to the general session through their representatives. One would strongly wish that the main problems would not be missed or inadequately expressed on account of language difficulties.

The Council passed unanimously the following five resolutions:

The first resolution on "State Trading in Foodgrains" was proposed by Shri Hanumanta Rao (Mysore) and seconded by Capt. Charan Singh (Punjab).

I. State Trading in Foodgrains

(i) The All-India Farmers' Council has noted the statement made by the Minister for Food and Agriculture in the Lok Sabha on State Trading in Foodgrains on the 2nd of April 1959 and is glad that a cautious beginning in State Trading is being made.

(ii) The primary objective of State Trading in Foodgrains, as accepted by the Government, is to maintain price levels, which are fair both to the producer as well as to the consumer and to reduce to the minimum the disparity between the prices received by the farmer and the prices paid by the consumer throughout the season and over an agricultural cycle. The Council approves of this objective.

(iii) The scheme as announced falls into two parts. Firstly the "interim scheme" to be worked till the establishment of full-scale State Trading and the "ultimate pattern". In the interim period, the scheme provides that wholesale dealers will be permitted to function as licensed traders, who will make purchases on their own behalf but shall pay specified minimum prices to the farmer. The ultimate pattern provides for the collection of farm surpluses through service co-operatives at the village level and the channelling of the surpluses through marketing co-operatives and apex marketing societies for distribution through retailers and through consumers' co-operative soceities.

(iv) While the Samaj generally welcomes the present scheme of the Government as it proceeds on the lines similar to those suggested by the Samaj to the Foodgrains Enquiry Committee, it feels that maximum vigilance would have to be exercised if the scheme is not to go astray at the hands of unscrupulous wholesale dealers and lack of adequate control by the supervising authorities. The Council feels that unless proper care is taken during the interim period itself, the wholesale traders through their agents and village money-lenders may corner the stocks in the mofussil areas, pay very much lower prices than those specified by the Government to the growers on the ground of quality, etc., use traditionally false measures, insist on taking something extra without payment, etc., so that the benefit of minimum price envisaged in the scheme may not actually reach the producer.

(v) The Samaj also recommends that with a view to facilitate the speedy establishment of the ultimate pattern as suggested by the Government in the above scheme, it should introduce a system of bonus to be paid to farmers in case the foodgrains are delivered through Village Co-operatives or Market Unions of the farmers and sold at higher prices current in the markets.

(vi) The Council would like also to reiterate its faith in, and emphasise the need of the introduction of co-operative marketing on the largest possible scale at various points, especially in all the mandis in India. It, therefore, strongly suggests that the Government should take immediate steps to strengthen the co-operative sale-purchase societies or unions wherever they exist and help the members of the Bharat Krishak Samaj to bring into being such societies wherever they do not exist so that in the course of not more than a year or so every mandi will have a co-operative marketing organization. The Council thinks that this is the only way to subdue to a certain extent the instinct of profiteering at any cost by the private trade. Past experience also shows that as a rule co-operatives are unable to compete with private trade on equal terms. The Government should, therefore, take the utmost possible sympathetic view of their difficulties and protect them effectively from unfair competition and anti-social practices so rampant everywhere. It is only then that the co-operative organisations will be able to resort to grading, quality control and would be able to stand on their own legs. Without this assistance and adequate protection, co-operative marketing would find it impossible to succeed.

The second resolution on "Co-operative Farming" was proposed by Shri Amrithnath Aiyar (Kerala) and seconded by Sardar Satwant Singh (Punjab).

II. Co-operative Farming

(i) The All-India Farmers' Council notes and generally approves the decision taken by the 64th Session of the Indian National Congress held at Nagpur during January 1959 with regard to the future agrarian pattern of the country. The resolution passed at Nagpur envisages that the future agrarian pattern should be that of co-operative joint farming in which the land will be pooled for joint cultivation, the farmers continuing to retain their property rights and getting a share from the net produce in proportion to their land. Further, those who actually work on the land, whether they own the land or not, will get a share in proportion to the work put in by them on the joint farm.

(ii) As a first step, prior to the institution of joint farming, service co-operatives would be organised throughout the country. This stage

is proposed to be completed within a period of 3 years. Even within this period, however, wherever possible and wherever agreed to by the Farmers, joint cultivation may be started. The Lok Sabha has also endorsed the Nagpur Congress resolution envisaging the formation of service co-operatives as a first step towards introduction of joint co-operative farming.

(iii) The Samaj welcomes the bold decision of the Congress as the first step towards achieving a socialistic pattern of society and increasing the efficiency and productivity of the agricultural sector. Decisions in this particular sphere are in consonance with the aim, and ideals of the Bharat Krishak Samaj. It, however, wishes to emphasise the need to go ahead with speed to establish service co-operatives and urges liberal assistance to those who are prepared to resort to co-operative farming voluntarily and immediately.

(iv) In this connection, the Council wishes to bring to the notice of the Government the resolution passed by it in its 4th meeting in Amravati since in essence it still holds good, namely:

> "The Farmers' Council feels that the efforts to organise, revitalise and strengthen the various types of societies can succeed only to the extent that co-operative principles and practices are accepted by the farmers and leadership is provided by them. This means that the farmers have to be educated and prepared to take part in the process and guided properly to achieve the desired end through it. Such a stupendous task is beyond the capacity of the single agency of the Government.
>
> "In every country of the world, wherever co-operation has succeeded in the field of agriculture, this process has been gradually achieved through the agency of the Farmers' Organizations, which not only provided the requisite education to their constituents, to own co-operative principles but also provided all the guidance and technical skill required to set up co-operative societies for specific purposes and shown them the way to run them efficiently and achieve the desired object. To prepare the farmers of India to take actively to co-operation is a still greater and more arduous task and an active Farmers' Organization like the Farmers' Forum alone can help our nation to reach the cherished goal.
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> "The Council, therefore, requests the Union Government and also the Governments in the States that if they are really earnest to build an efficient and suitable Co-operative Movement in the country, they should not hesitate to take the organization of the farmers into confidence and strive to complete the process through this intermediary. Unless it is done, the Farmers' Council

is confident that the Government will not be able to develop a really efficient Co-operative Movement in the country which will be of any real help to the farmers."

(v) The Council reiterates its resolve to help the Co-operative Movement in all its aspects and especially help the Service Co-operatives as well as Co-operative Farms wherever they may be set up. The Council, however, does not favour the idea of restricting the spread of the large-scale societies and somewhat exaggerated emphasis on small societies. The Council has no hesitation in stating its view that the chances of speedy success in the direction in which the Government is seeking to go are not likely to be very bright.

(vi) The Council thinks that the Government has not taken into proper account the history of the Co-operative Movement in the country for the last 50 years and the realities of the situation. The main reason for its failure in the past was its inadequate resources and lack of leadership. If undue insistence is placed on small societies the Council thinks that there is nothing to prevent the same unhappy experience being repeated because it is not possible to create leadership in every village overnight nor can any agency, governmental or otherwise, nor is it possible to advance to each small society even 10% of the credit they require in spite of all the best we have. The Council, therefore, thinks that the Government should not give up the well-thought-out scheme of the large-sized societies as they were envisaged and planned in the Second Five-Year Plan and reiterates its demand made at its meeting at Bhubaneswar that the whole programme should be permitted to go forward unimpaired till the end of the Second Five-Year Plan.

The third resolution on "National Farmers' Bank" was proposed by Capt. Charan Singh and seconded by Shri Rayan Gouda Patil.

III. National Farmers' Bank

The All-India Farmers' Council reiterates the resolution passed in its 5th meeting held in New Delhi that a National Farmers' Bank should be established in the country to supplement the credit needs of the smaller agriculturists. It has noted the steps that have been initiated by the Central Office in this connection and calls upon the farmers of India to support the establishment of such a Bank in the country.

The fourth resolution of "Price Fixation" was proposed by Shri L. T. Karle (Mysore).

IV. Price Fixation

The All-India Farmers' Council reiterates its resolution adopted in its 2nd meeting in September 1956 and 6th meeting in November 1958 and express satisfaction that the Indian National Congress in its 64th Session in Nagpur has accepted the principle of the fixation of the minimum floor price for the crops reasonably in advance of the sowing season. In this connection it urges upon the Government that the question of the fixation of the minimum price for important agricultural commodities should be given the highest priority in any programme of higher food production in the country. The Council is also of opinion that a guaranteed economic price to the farmer acts as a great incentive for intensification of his efforts to produce more from his land. It also wishes to urge upon the Government that the fixation of any price for the agricultural commodities should be done in full consultation with the recognized organisations of the farmers of India. The Council would also like to point out the delay that has already been observed in implementing price support policy. Occasionally it has been found that although a particular price for a particular commodity is announced as the minimum price the arrangements for purchases are either inadequate or inordinately delayed. The result is that a large body of farmers are not saved from avoidable losses. The Council feels that in future it will be seen that this kind of situation is not allowed to develop anywhere at any time.

The fifth resolution on "Agricultural Supplies" was proposed by Shri Anil Zhaveri (Bombay) and seconded by Shri M. C. Bondriya (M.P.).

V. Agricultural Supplies

(*a*) *Fuel Oil.*—The All-India Farmers' Council requests the Government of India that the diesel and all-vapourising oils used by the farmers should be exempted from the levy of excise duty and a suitable system be evolved whereby the farmers are able to purchase the quantity of oil needed by them without any surcharge duty.

(*b*) *Agricultural Machinery, Spare Parts and Tyres.*—The All-India Farmers' Council wishes to bring to the notice of the Government of India that considerable difficulty is being felt by the farmers in getting the spare parts of tractors which are being used by them on their farms. The Government of India during the past years have introduced a variety of models of tractors in the country. In several cases the import of those tractors have ceased with the result that spare parts for those tractors are not at all available today. In other cases, due to a severe curtailment in the quotas of the spare parts, it is very often impossible for the farmers to get the same. Very often the farmers have

to wait for many months to get the supply of a small part which makes the tractors remain idle for very long time. This state of affairs is very much hampering the efforts which these farmers are putting in for increasing food production from their land. The Council requests the Government of India to liberalize the import of the spare parts so that farmers do not suffer on account of the shortage of the same. It further requests the Government of India to import only very few kinds of and tried models of tractors in the country so that farmers may be saved from difficulties which they may have to face during future years if they happen to purchase tractors which may be imported in small quantities to tide over the temporary shortage and which are bound to go out of market in future when tractors are progressively manufactured in the country.

(*c*) *Fertilizers.*—The All-India Farmers' Council also wishes to bring to the notice of the Government of India the difficulties that farmers are experiencing in the supply of fertilizers. As higher yield from land is very much in proportion to the amount of nutrition that is available in the soil. It therefore requests the Government to allot maximum funds and exchange so that it may be possible to import more fertilizers and their shortage may not seriously hamper the increase in the food production in the country. The prices of fertilizers also should be brought down to world prices.

(*d*) *Electricity Supply for Irrigation Purposes.*—The All-India Farmers' Council also desires to convey to the Government of India that wherever electric current is available, preference for supply invariably be given for purposes of agriculture. It also requests that the rate of unit of current for agricultural purposes should be much less than that charged for industrial use. It further requests the Government that the State Governments may be requested to carry out survey of areas where electric current is available and where wells could be dug and pumps could be installed for lifting water from them. The Council feels that lack of water for irrigation purposes is severely hampering the cause of agricultural production in the country and it suggests that immediate steps must be initiated in this direction so that agricultural production does not suffer till it is possible to have irrigation water from the major irrigation projects.

(*e*) *Insecticides.*—The Council requests the Government of India to see that the imported insecticides are sold in the market at reasonable prices and look into the advisability of fixing them.

—SECRETARY.

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